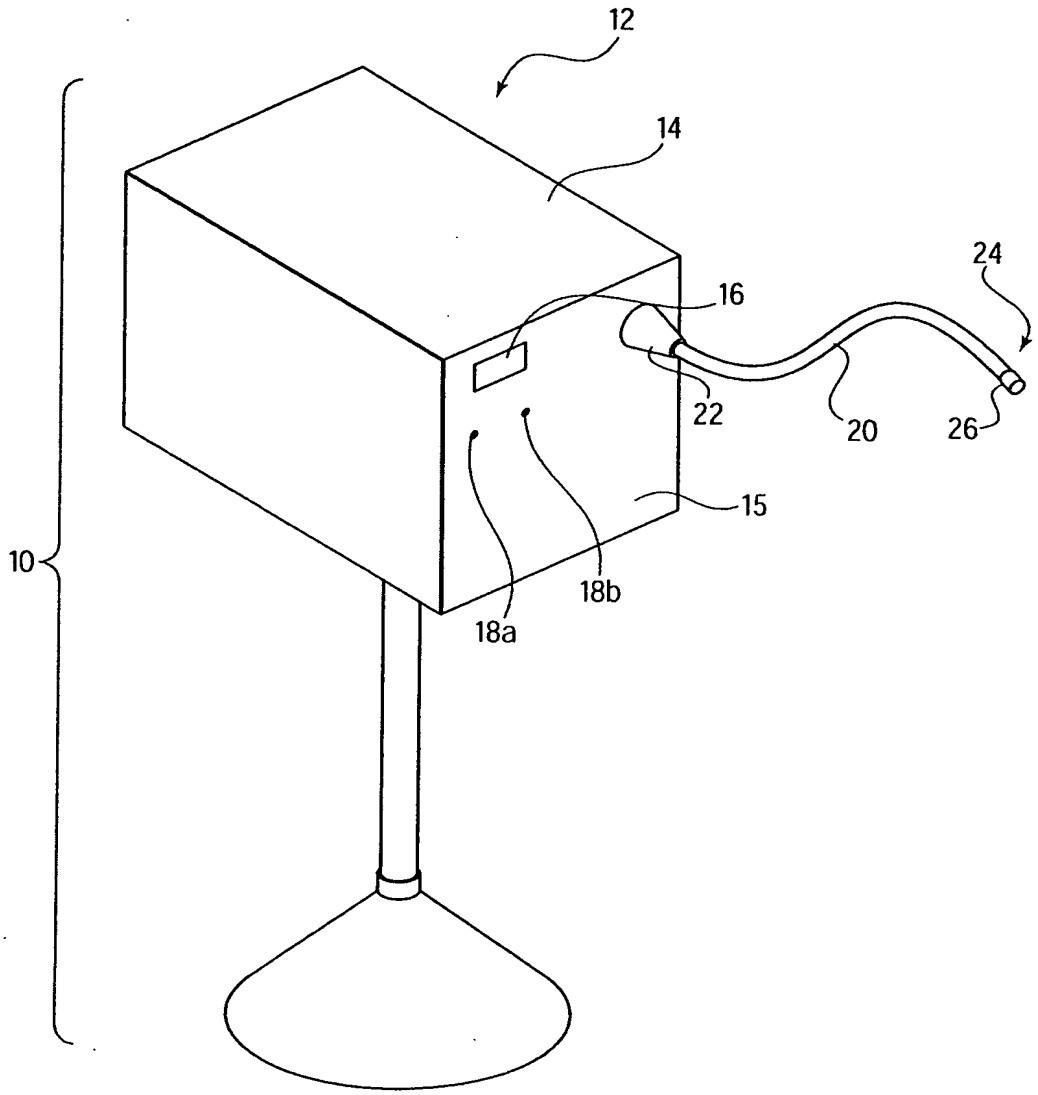


Fig. 1

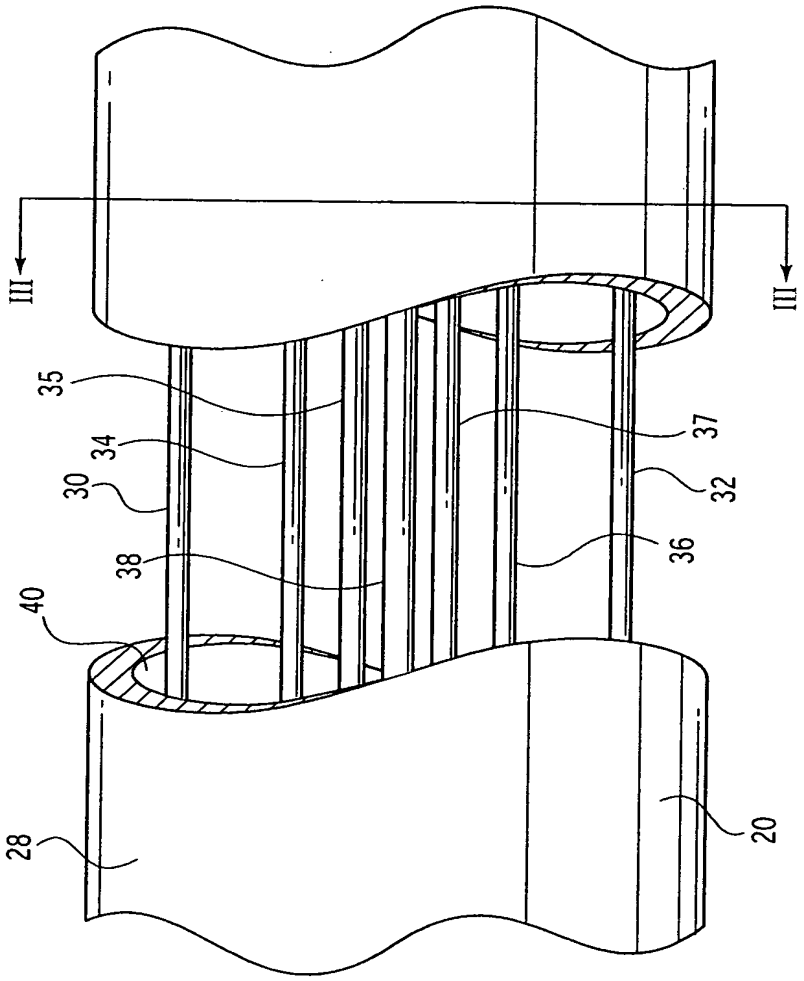


Fig. 2

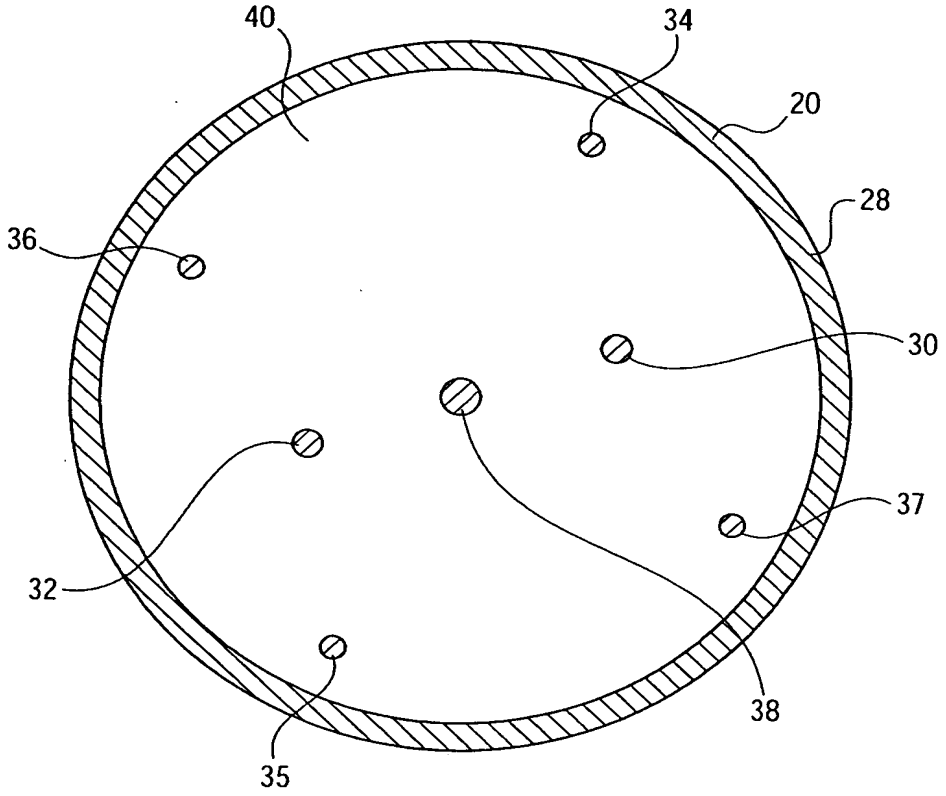


Fig. 3

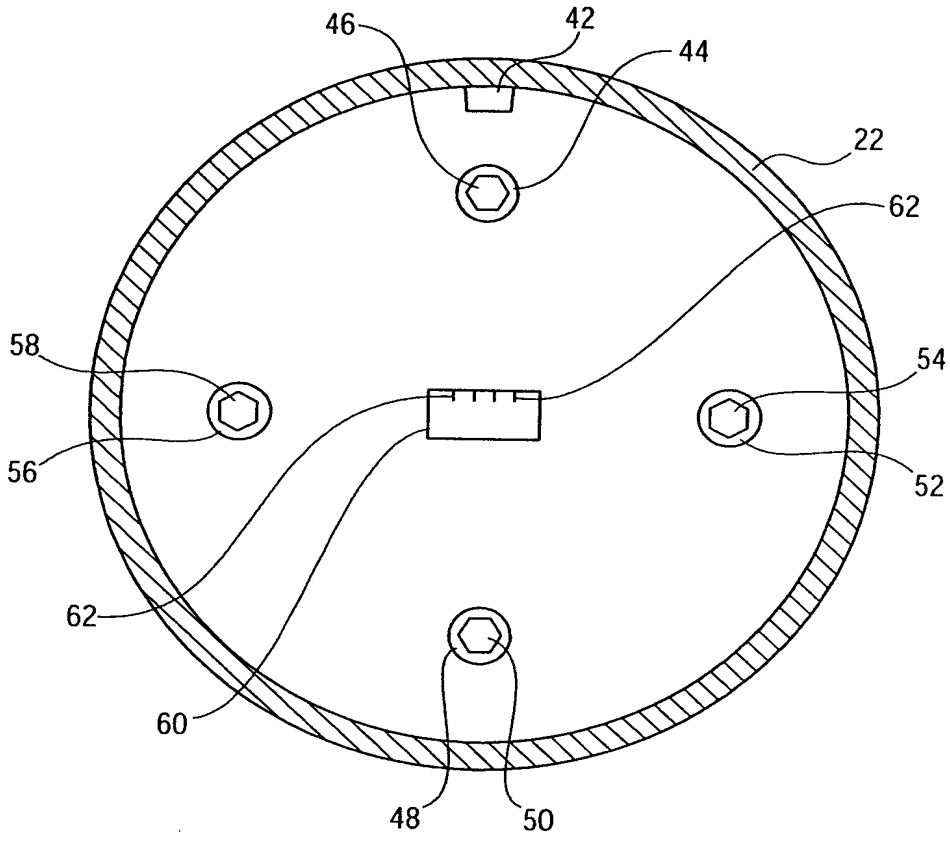


Fig. 4

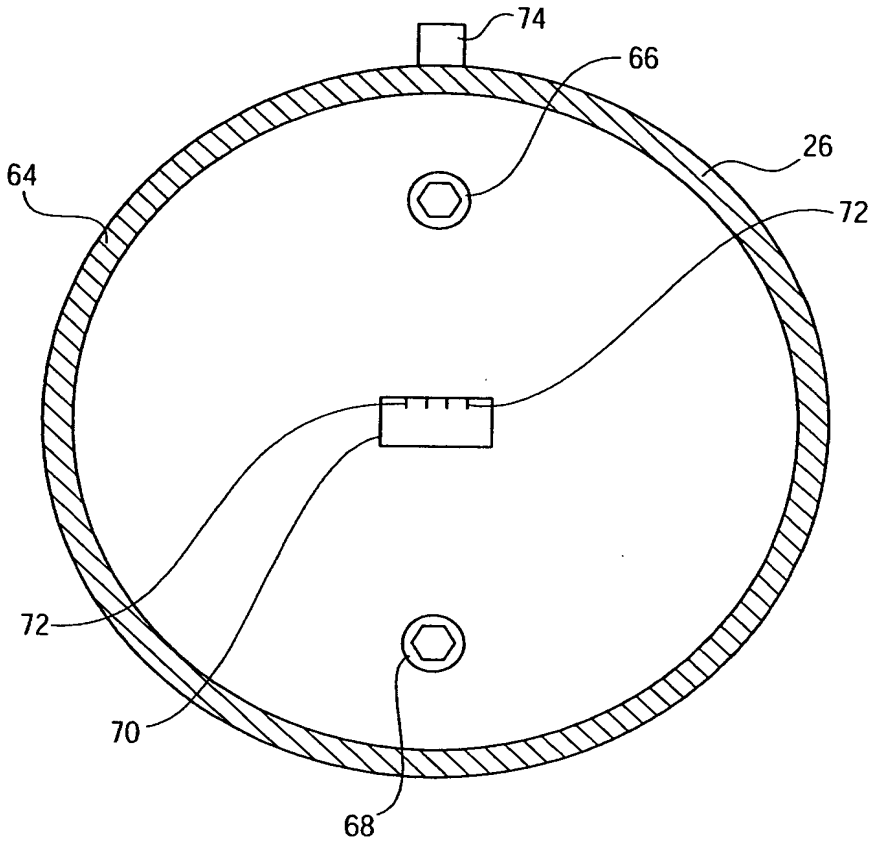


Fig. 5

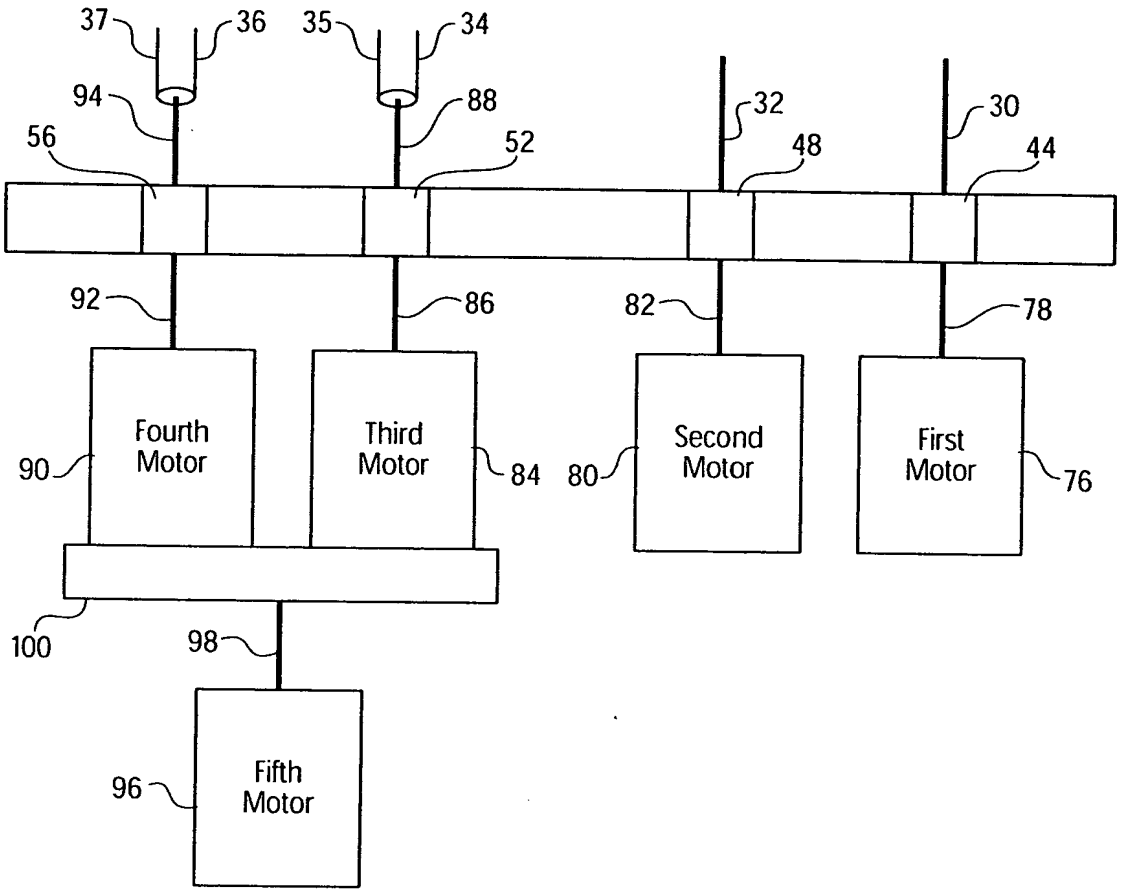

37
36
35
34
94
88
32
30
56
52
48
44
92
86
82
78
Fourth Motor
Third Motor
Second Motor
First Motor
90
84
80
76
100
98
Fifth Motor
96

Fig.6

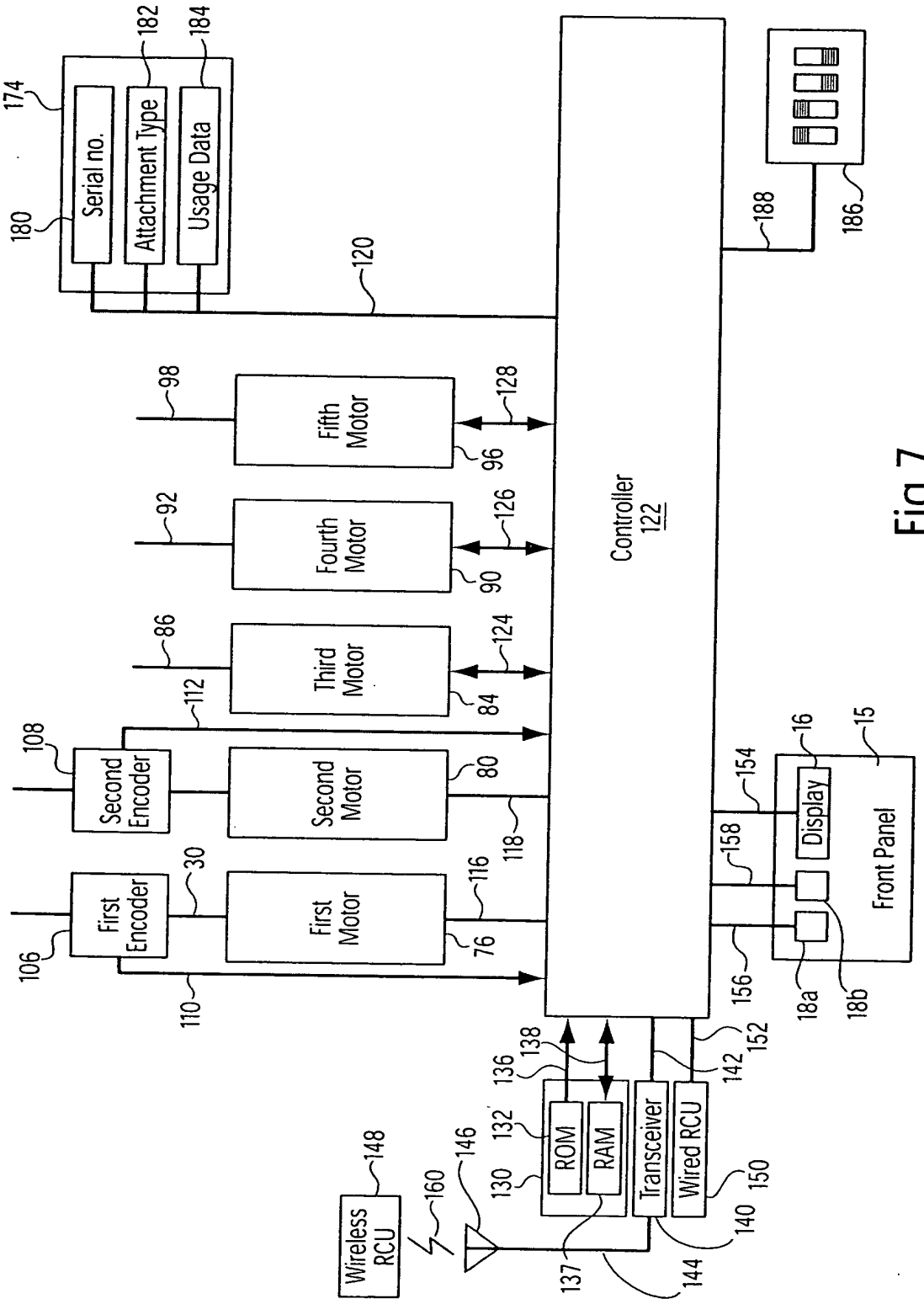

Serial no.
Attachment Type
Usage Data
174
180
182
184
120
188
186
Controller
122
Fifth Motor
98
96
128
Fourth Motor
92
90
126
Third Motor
86
84
124
Second Encoder
108
Second Motor
80
112
118
First Encoder
106
30
First Motor
76
116
110
Display
16
Front Panel
15
154
158
156
18a
18b
152
142
138
136
ROM
RAM
132
130
Transceiver
Wired RCU
140
150
144
137
Wireless RCU
148
146
160

Fig.7

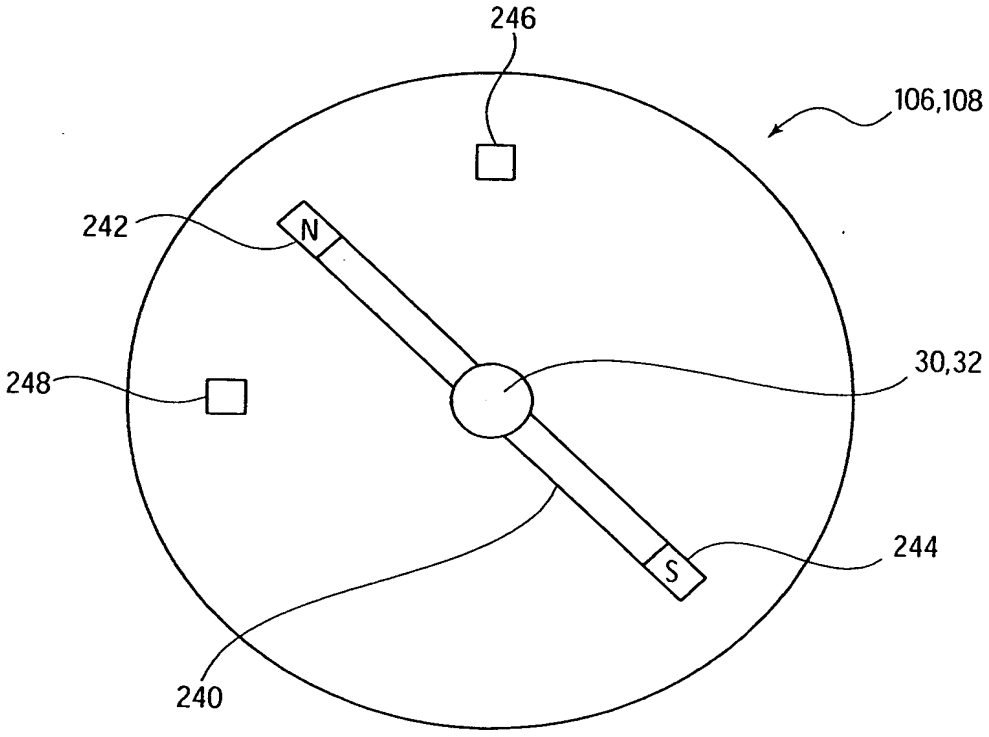


Fig. 8

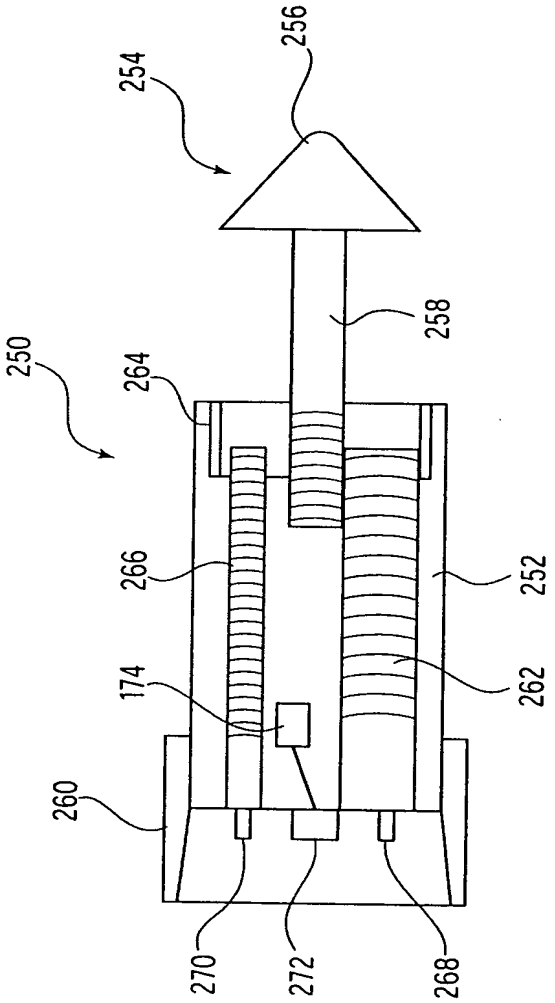


Fig. 9A

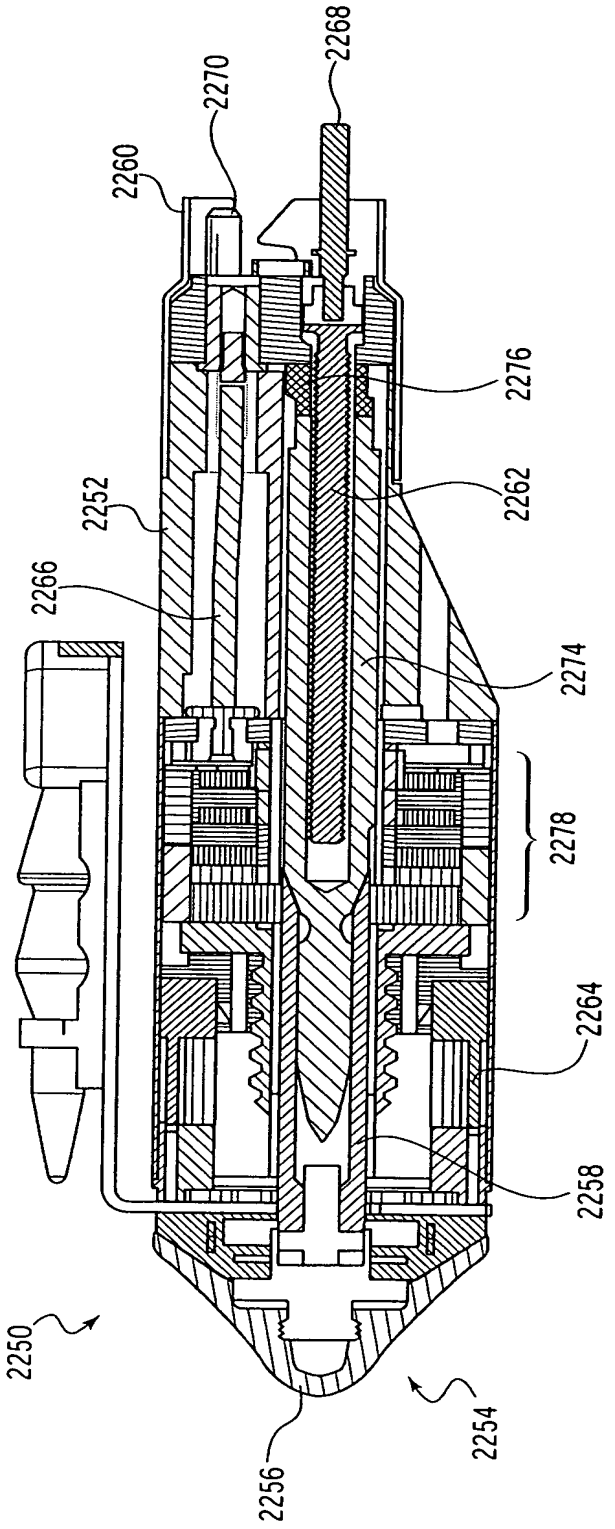

2268
2270
2260
2276
2262
2252
2266
2274
2278
2264
2258
2250
2254
2256

Fig. 9b

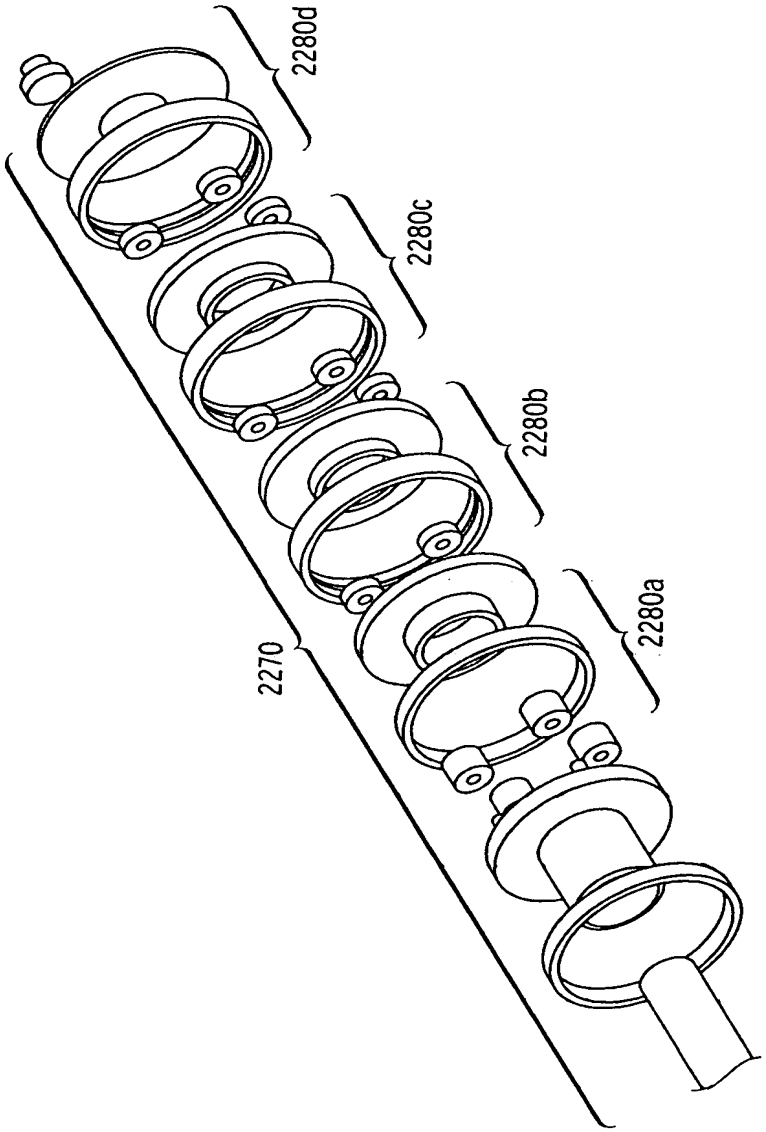


Fig. 9c

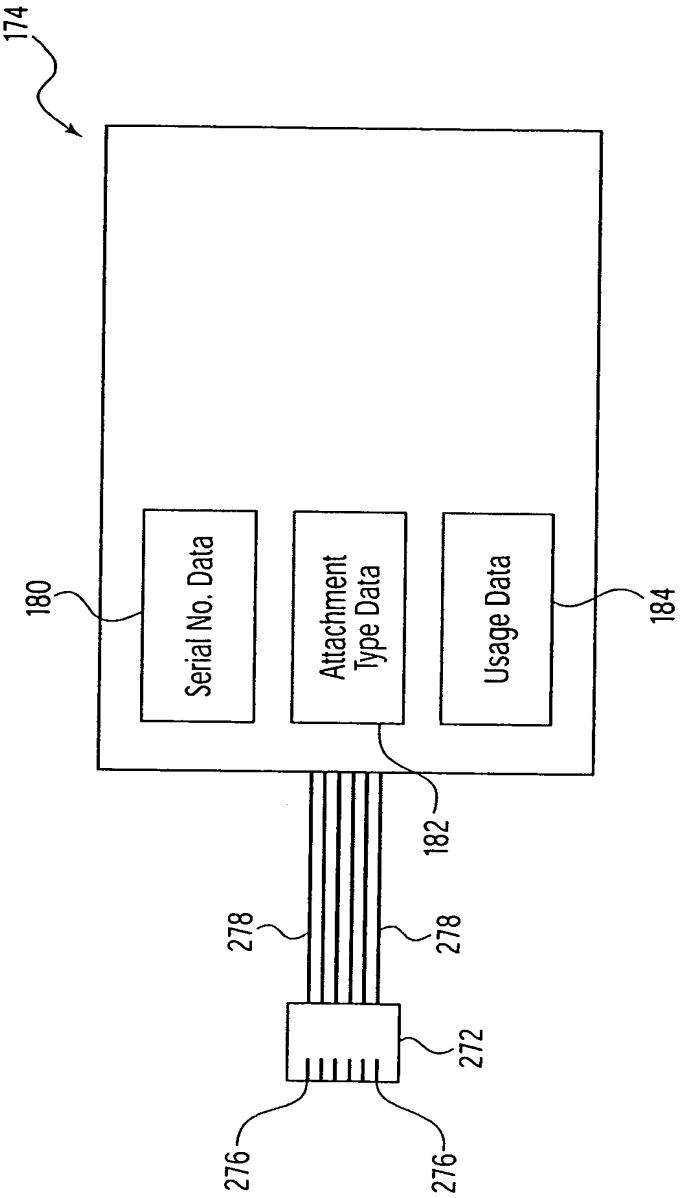

174
Serial No. Data
Attachment Type Data
Usage Data
180
182
184
278
278
272
276
276

Fig. 10

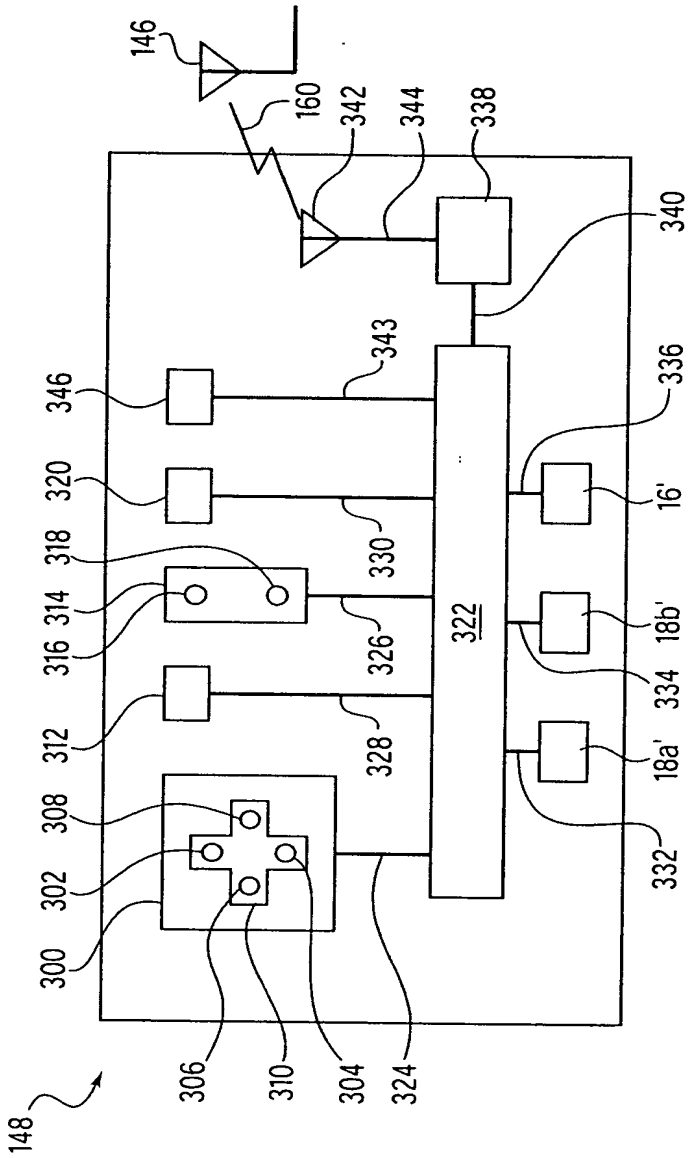

146
160
342
344
338
340
343
346
320
318
314
316
312
308
302
300
330
326
328
322
336
16'
18b'
334
18a'
332
306
310
304
324
148

Fig. 11

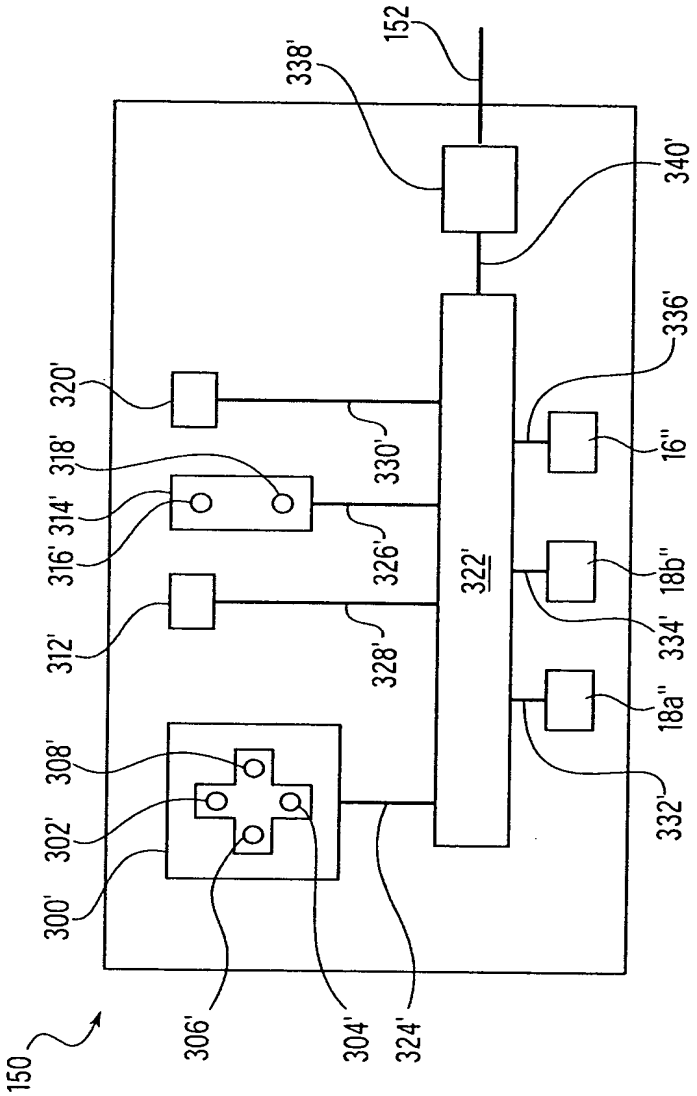

152
338'
340'
336'
320'
318'
314'
316'
312'
308'
302'
300'
330'
326'
328'
322'
16"
18b"
18a"
334'
332'
306'
304'
324'
150

Fig. 12

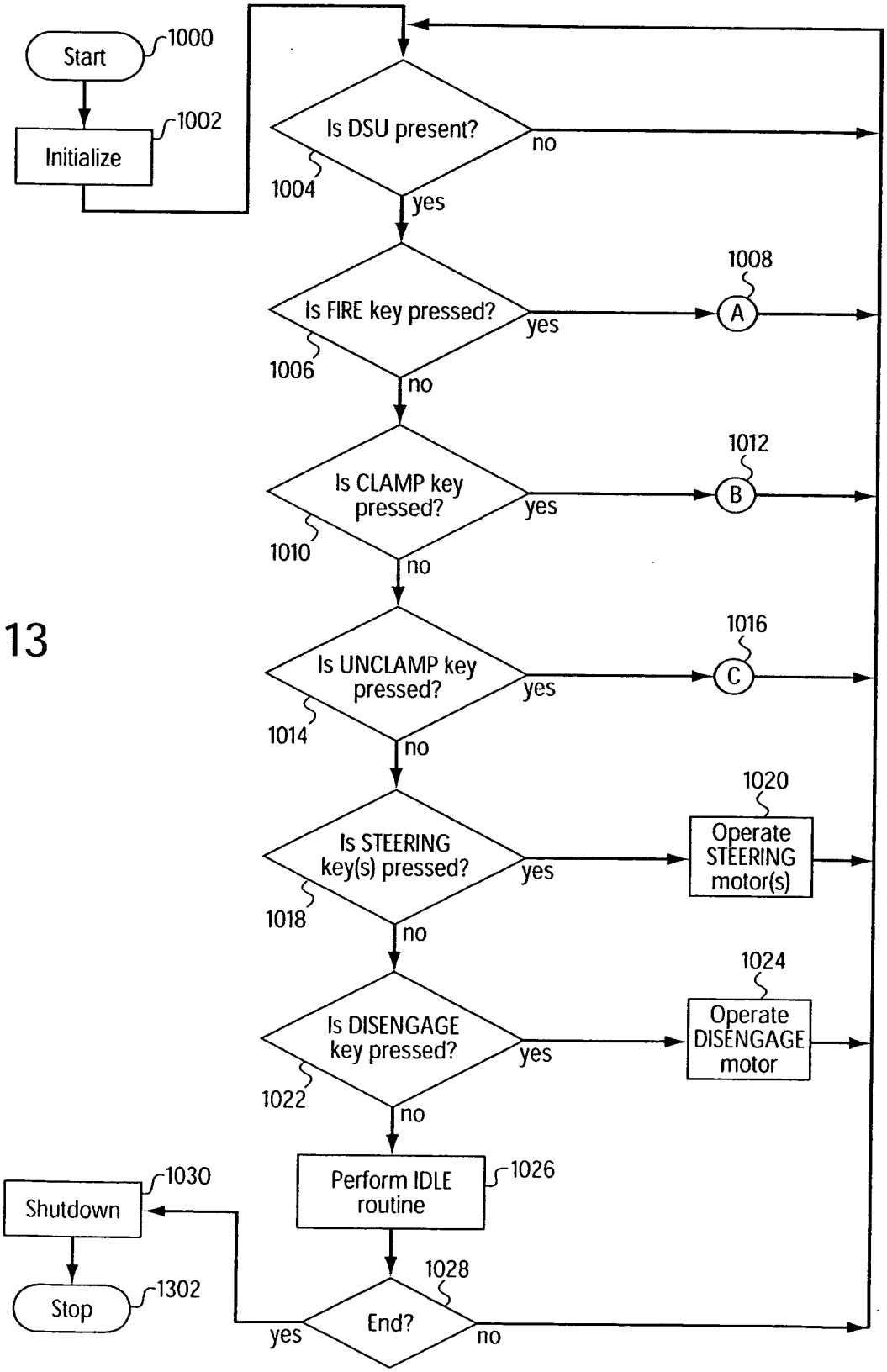

Start
1000
Initialize
1002
Is DSU present?
1004
no
yes
Is FIRE key pressed?
1006
1008
A
yes
no
Is CLAMP key pressed?
1010
1012
B
yes
no
Is UNCLAMP key pressed?
1014
1016
C
yes
no
Is STEERING key(s) pressed?
1018
1020
Operate STEERING motor(s)
yes
no
Is DISENGAGE key pressed?
1022
1024
Operate DISENGAGE motor
yes
no
Perform IDLE routine
1026
Shutdown
1030
Stop
1302
End?
1028
yes
no

Fig. 13

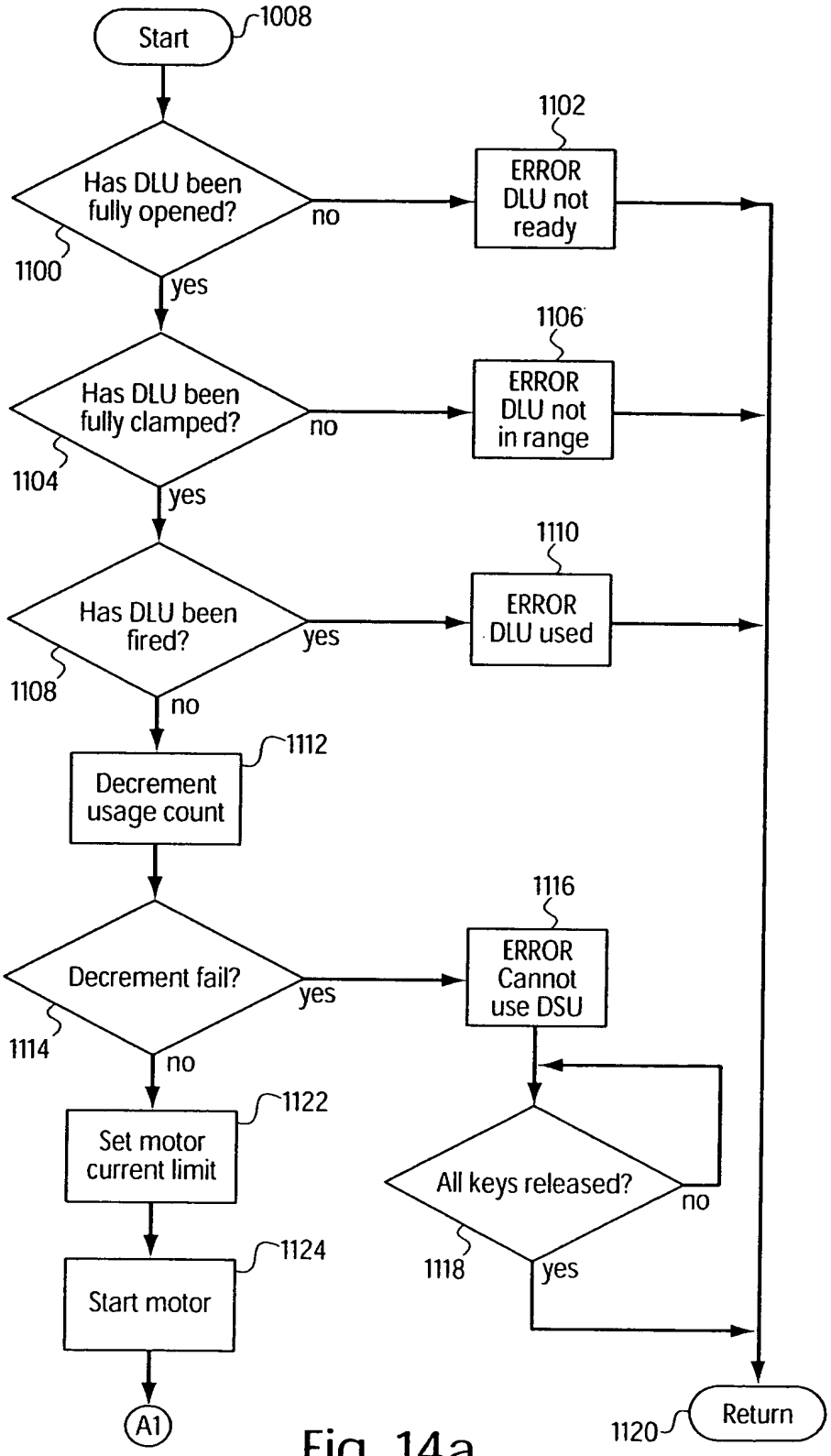

Start
1008
Has DLU been fully opened?
1100
no
1102
ERROR DLU not ready
yes
Has DLU been fully clamped?
1104
no
1106
ERROR DLU not in range
yes
Has DLU been fired?
1108
yes
1110
ERROR DLU used
no
Decrement usage count
1112
Decrement fail?
1114
yes
1116
ERROR Cannot use DSU
no
Set motor current limit
1122
Start motor
1124
A1
All keys released?
1118
no
yes
Return
1120

Fig. 14a

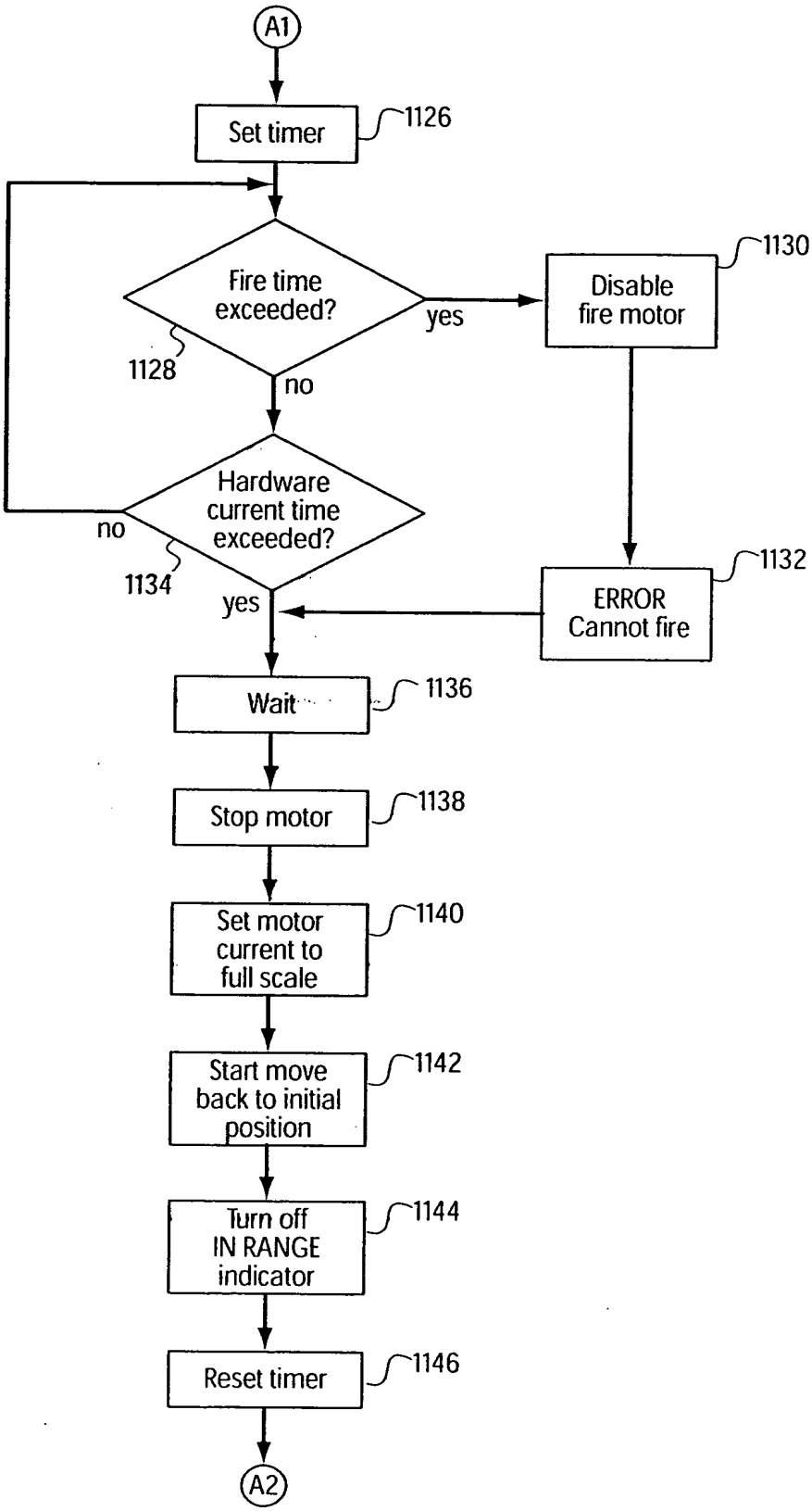

A1
Set timer
1126
Fire time exceeded?
yes
1130
Disable fire motor
1128
no
Hardware current time exceeded?
no
1134
yes
1132
ERROR Cannot fire
Wait
1136
Stop motor
1138
Set motor current to full scale
1140
Start move back to initial position
1142
Turn off IN RANGE indicator
1144
Reset timer
1146
A2

Fig. 14b

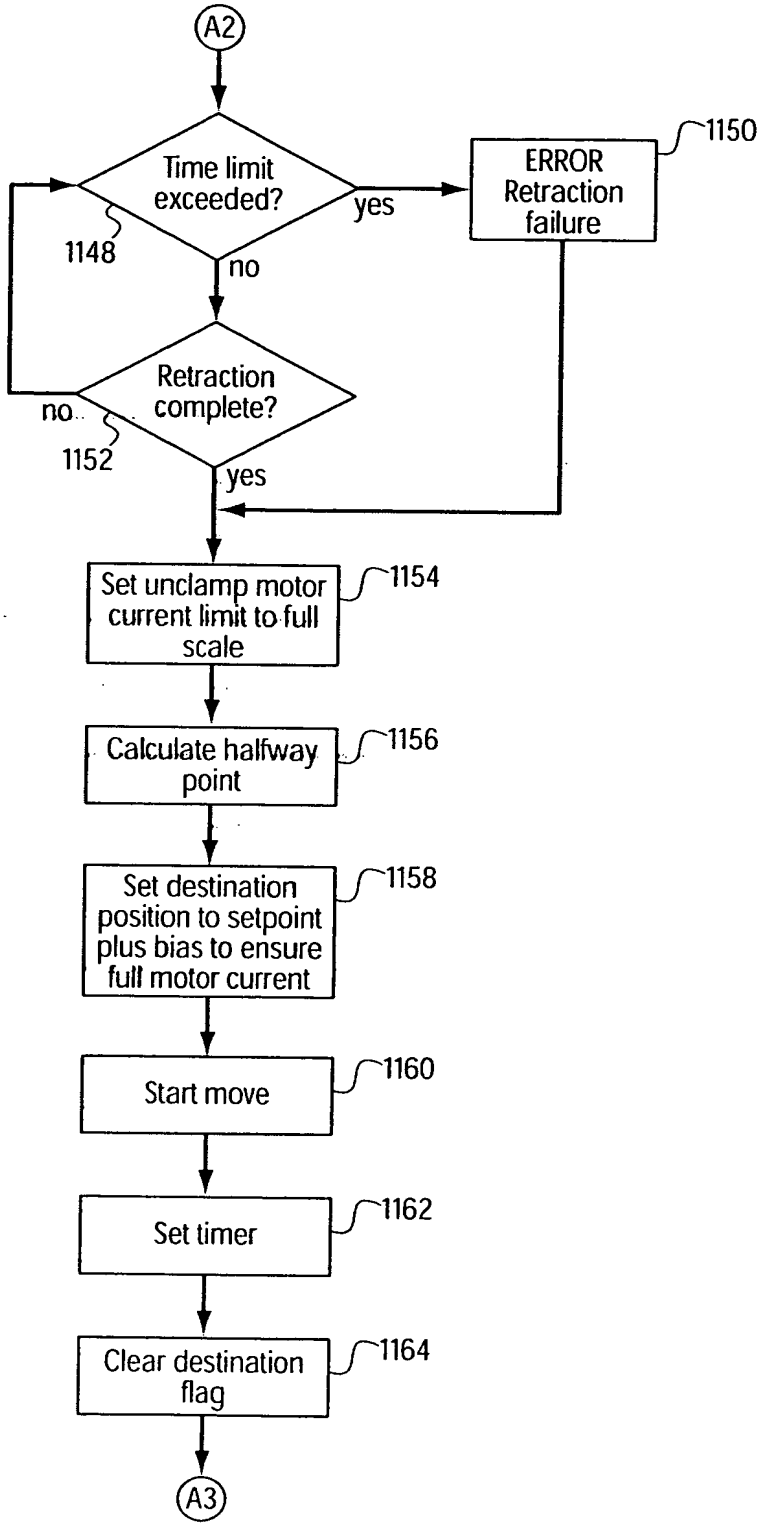

A2
Time limit exceeded?
yes
ERROR Retraction failure
1150
1148
no
Retraction complete?
no
1152
yes
Set unclamp motor current limit to full scale
1154
Calculate halfway point
1156
Set destination position to setpoint plus bias to ensure full motor current
1158
Start move
1160
Set timer
1162
Clear destination flag
1164
A3

Fig. 14c

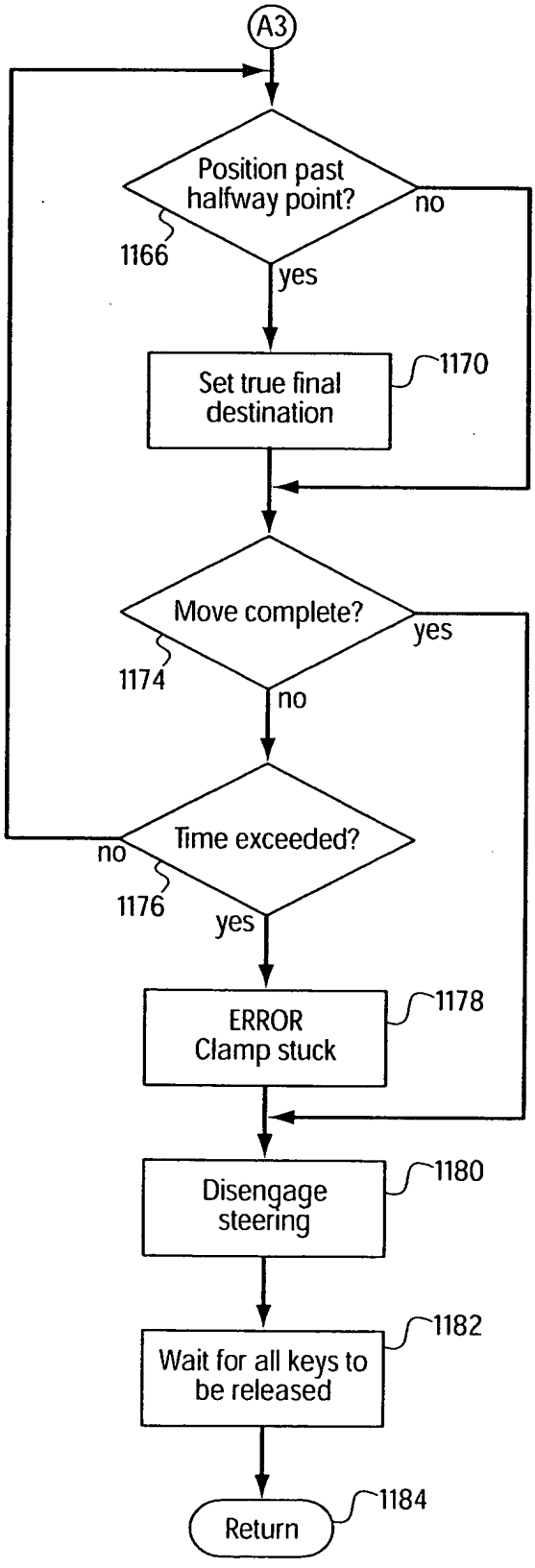

A3
Position past halfway point?
no
1166
yes
Set true final destination
1170
Move complete?
yes
1174
no
Time exceeded?
no
1176
yes
ERROR Clamp stuck
1178
Disengage steering
1180
Wait for all keys to be released
1182
Return
1184

Fig. 14d

Fig.15a

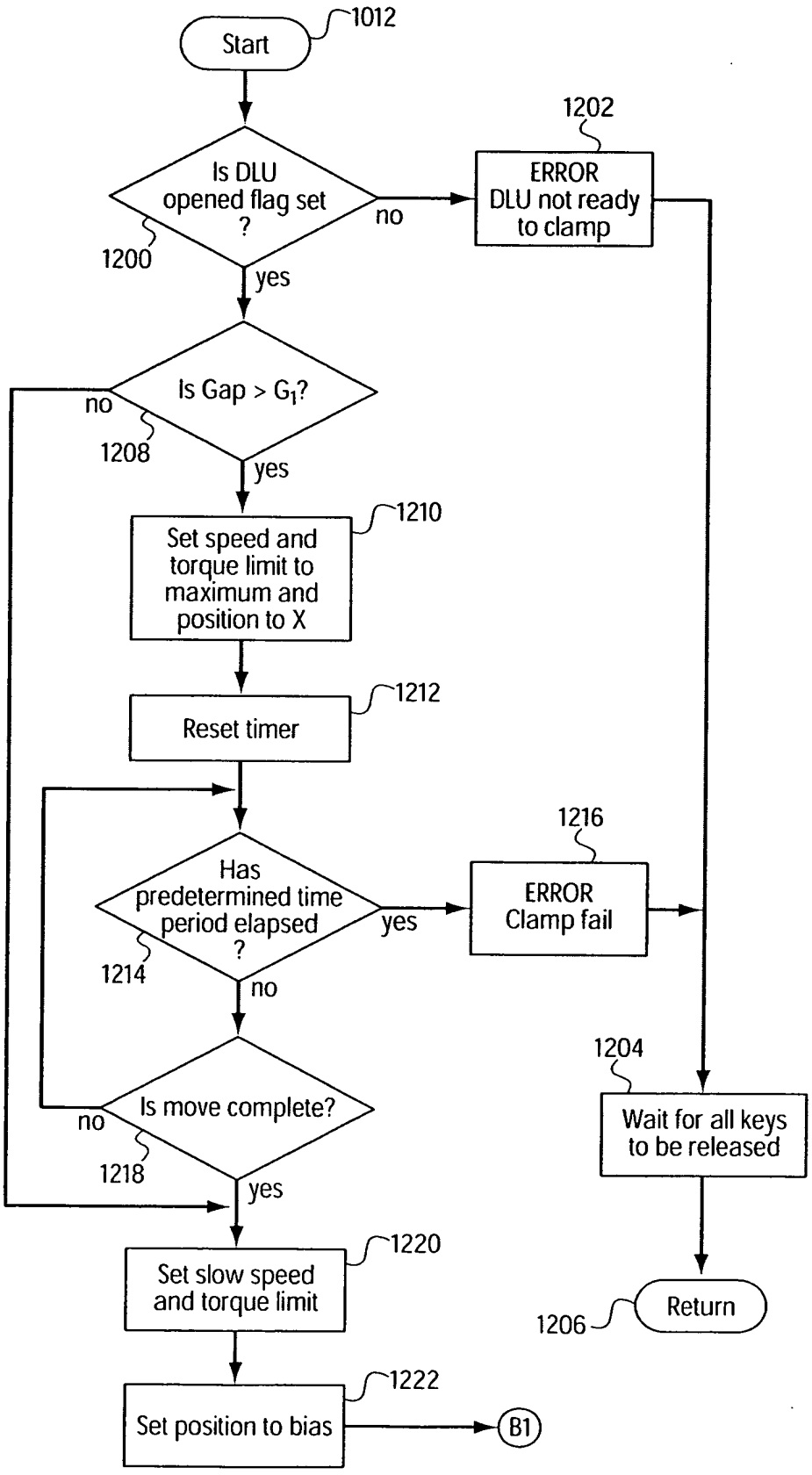
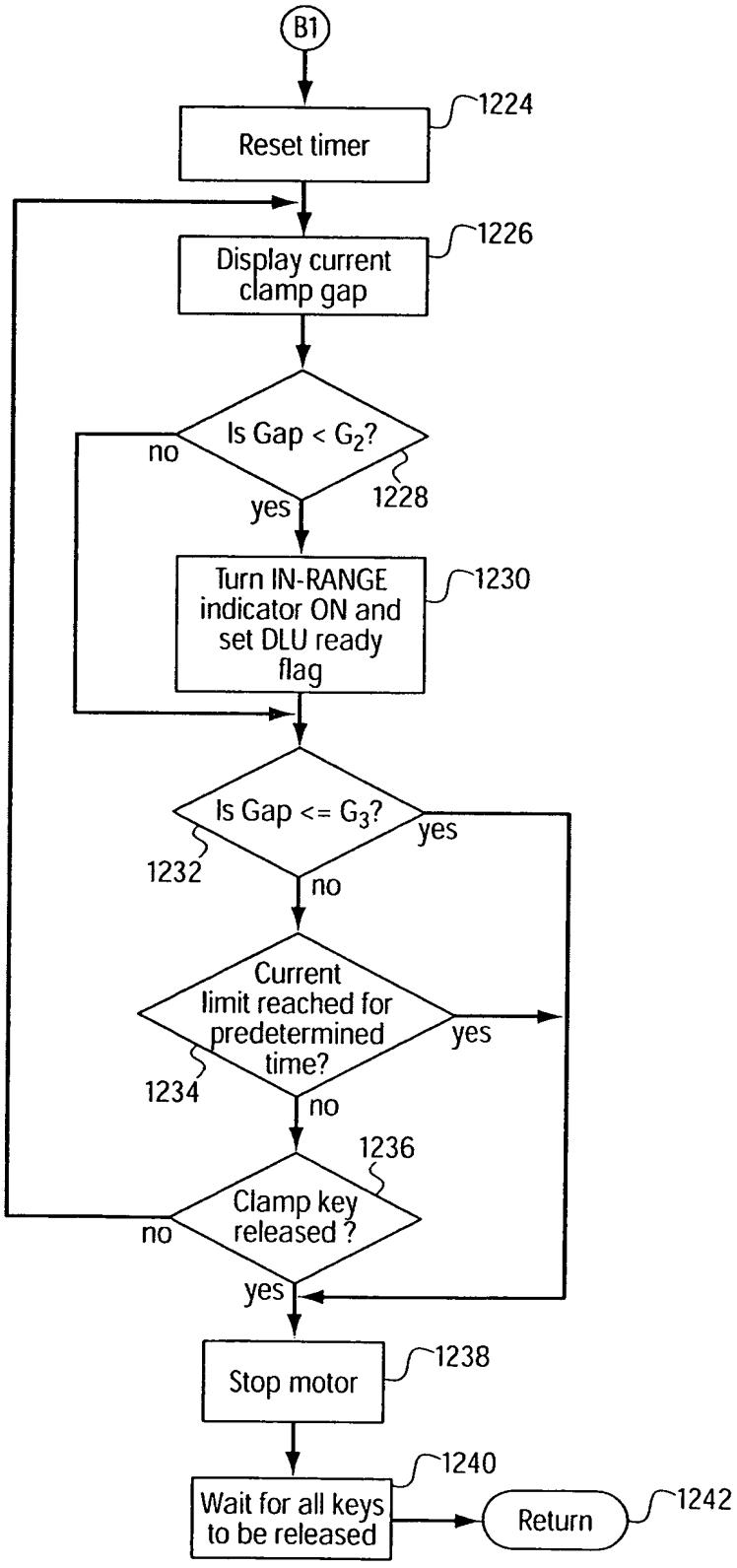

Start
1012
Is DLU opened flag set ?
1200
no
1202
ERROR DLU not ready to clamp
yes
Is Gap > G_1?
no
1208
yes
Set speed and torque limit to maximum and position to X
1210
Reset timer
1212
Has predetermined time period elapsed ?
1214
yes
1216
ERROR Clamp fail
no
Is move complete?
no
1218
yes
1204
Wait for all keys to be released
Set slow speed and torque limit
1220
Return
1206
Set position to bias
1222
B1

Fig.15b


B1
Reset timer
1224
Display current clamp gap
1226
Is Gap < G_2?
no
yes
1228
Turn IN-RANGE indicator ON and set DLU ready flag
1230
Is Gap <= G_3?
yes
1232
no
Current limit reached for predetermined time?
yes
1234
no
1236
Clamp key released ?
no
yes
Stop motor
1238
1240
Wait for all keys to be released
Return
1242

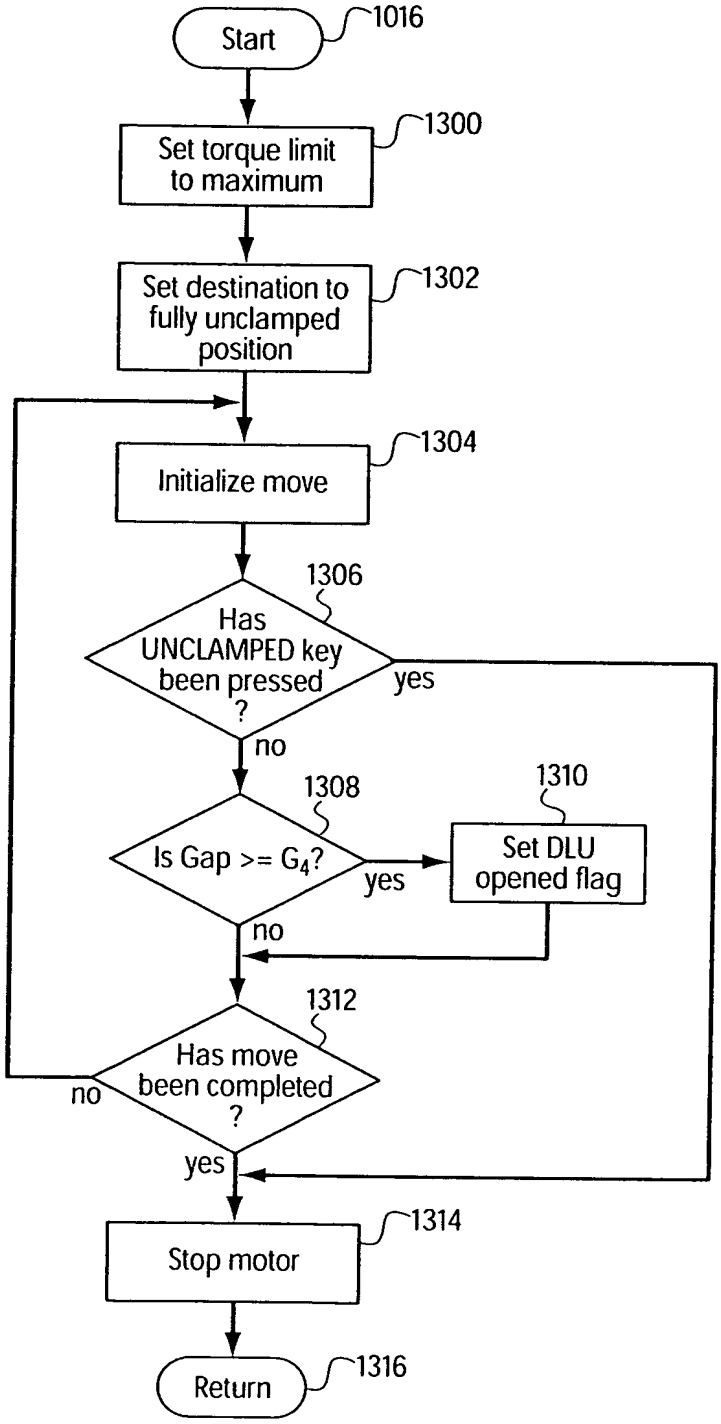

Start
1016
Set torque limit to maximum
1300
Set destination to fully unclamped position
1302
Initialize move
1304
Has UNCLAMPED key been pressed ?
1306
yes
no
Is Gap >= G_4?
1308
yes
Set DLU opened flag
1310
no
Has move been completed ?
1312
no
yes
Stop motor
1314
Return
1316

Fig.16

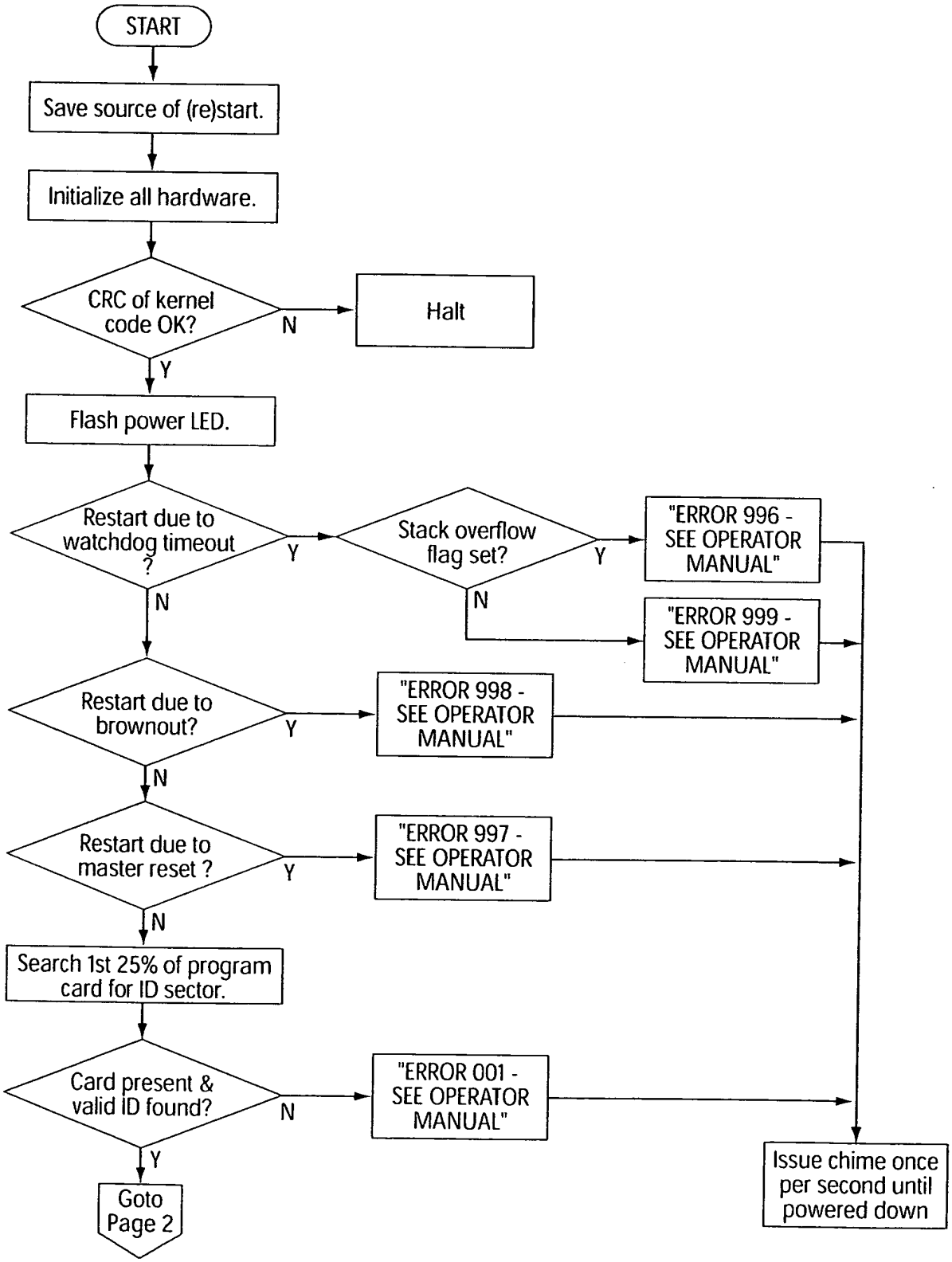

START
Save source of (re)start.
Initialize all hardware.
CRC of kernel code OK?
N
Halt
Y
Flash power LED.
Restart due to watchdog timeout ?
Y
Stack overflow flag set?
Y
"ERROR 996 - SEE OPERATOR MANUAL"
N
"ERROR 999 - SEE OPERATOR MANUAL"
N
Restart due to brownout?
Y
"ERROR 998 - SEE OPERATOR MANUAL"
N
Restart due to master reset ?
Y
"ERROR 997 - SEE OPERATOR MANUAL"
N
Search 1st 25% of program card for ID sector.
Card present & valid ID found?
N
"ERROR 001 - SEE OPERATOR MANUAL"
Y
Goto Page 2
Issue chime once per second until powered down

Fig. 17a

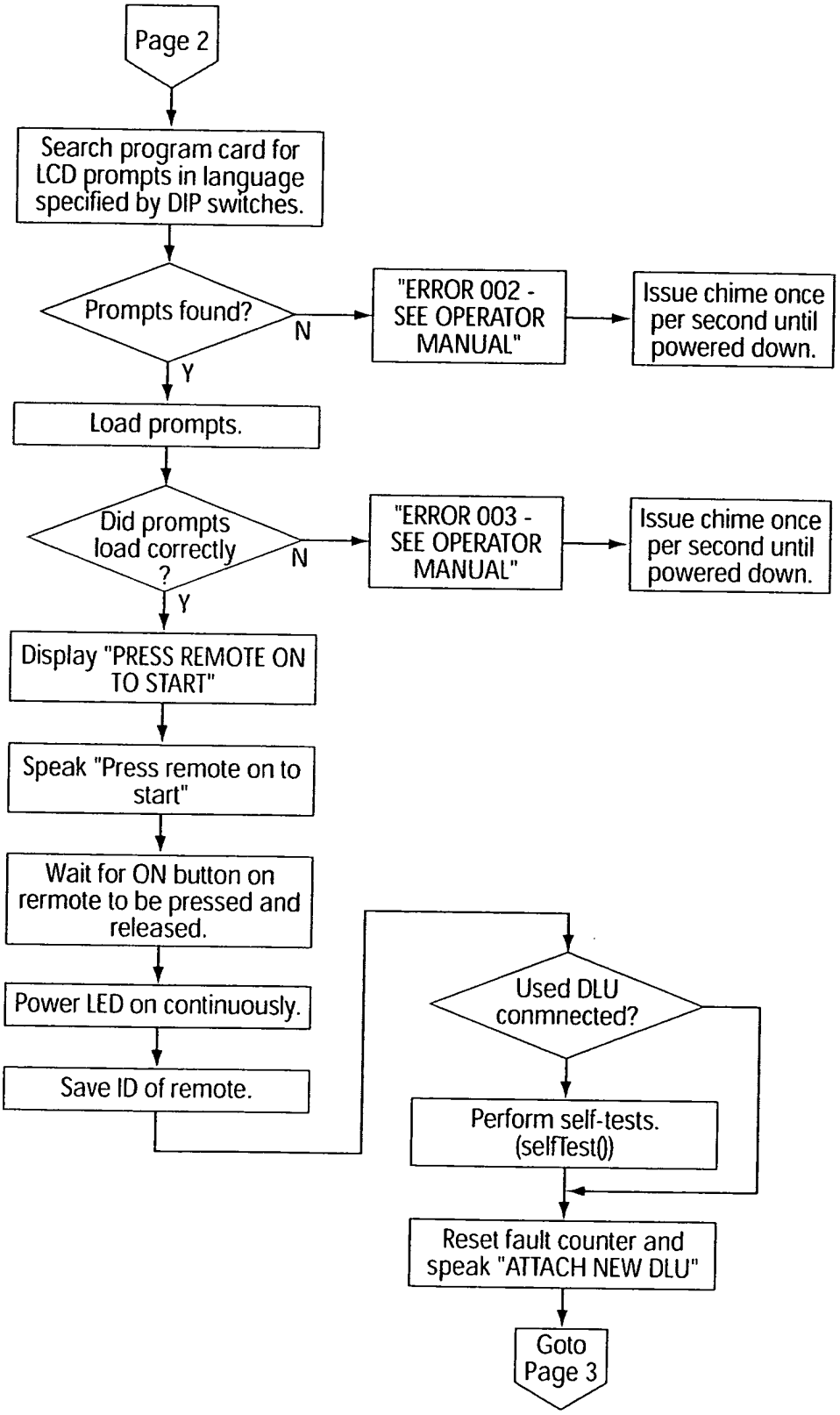

Page 2
Search program card for LCD prompts in language specified by DIP switches.
Prompts found?
N
"ERROR 002 - SEE OPERATOR MANUAL"
Issue chime once per second until powered down.
Y
Load prompts.
Did prompts load correctly ?
N
"ERROR 003 - SEE OPERATOR MANUAL"
Issue chime once per second until powered down.
Y
Display "PRESS REMOTE ON TO START"
Speak "Press remote on to start"
Wait for ON button on rermote to be pressed and released.
Power LED on continuously.
Save ID of remote.
Used DLU conmnected?
Perform self-tests. (selfTest())
Reset fault counter and speak "ATTACH NEW DLU"
Goto Page 3

Fig. 17b

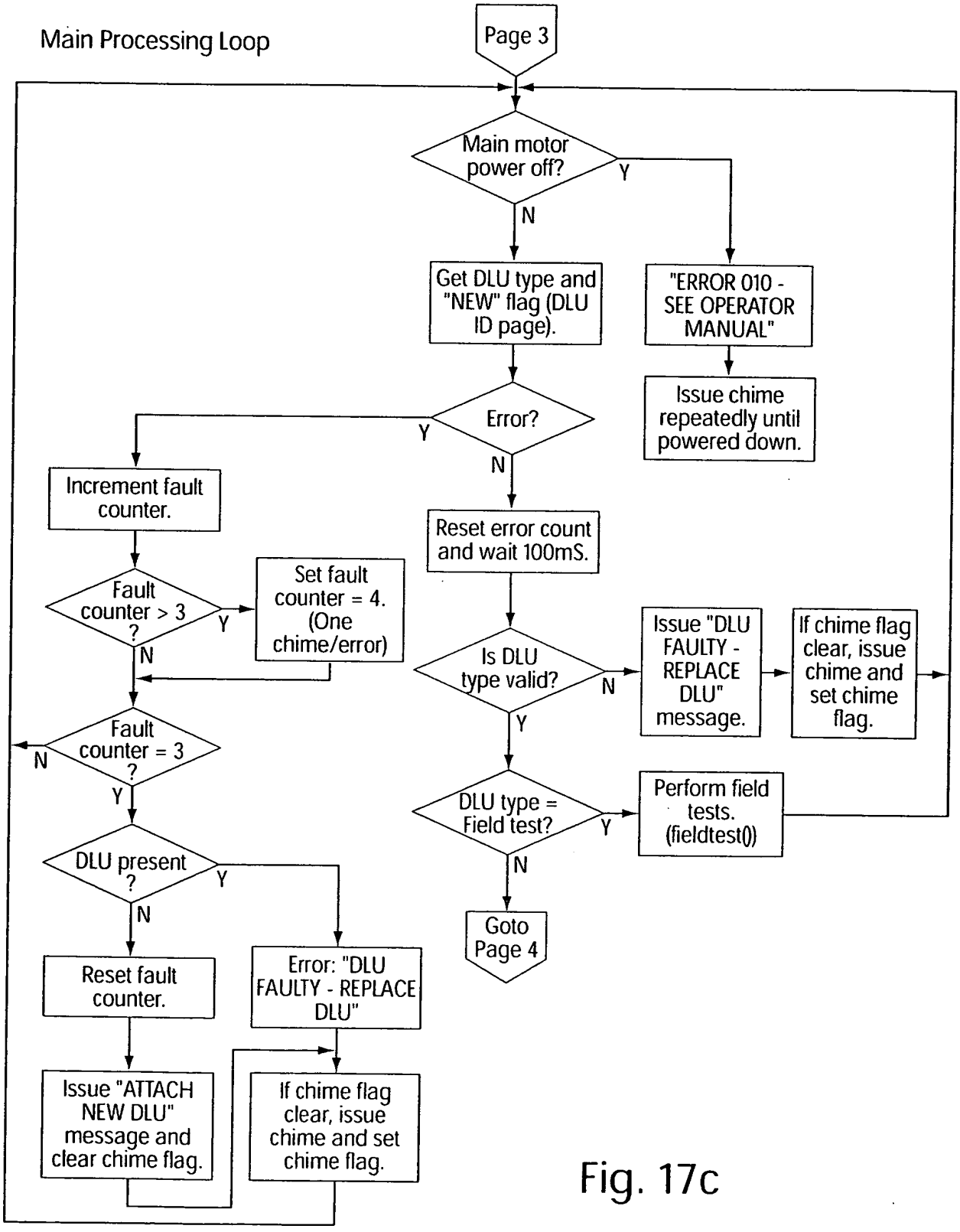

Main Processing Loop
Page 3
Main motor power off?
Y
N
Get DLU type and "NEW" flag (DLU ID page).
"ERROR 010 - SEE OPERATOR MANUAL"
Issue chime repeatedly until powered down.
Error?
Y
N
Increment fault counter.
Reset error count and wait 100mS.
Fault counter > 3 ?
Y
N
Set fault counter = 4. (One chime/error)
Is DLU type valid?
N
Y
Issue "DLU FAULTY - REPLACE DLU" message.
If chime flag clear, issue chime and set chime flag.
Fault counter = 3 ?
N
Y
DLU type = Field test?
Y
N
Perform field tests. (fieldtest())
DLU present ?
Y
N
Goto Page 4
Reset fault counter.
Error: "DLU FAULTY - REPLACE DLU"
Issue "ATTACH NEW DLU" message and clear chime flag.
If chime flag clear, issue chime and set chime flag.

Fig. 17c

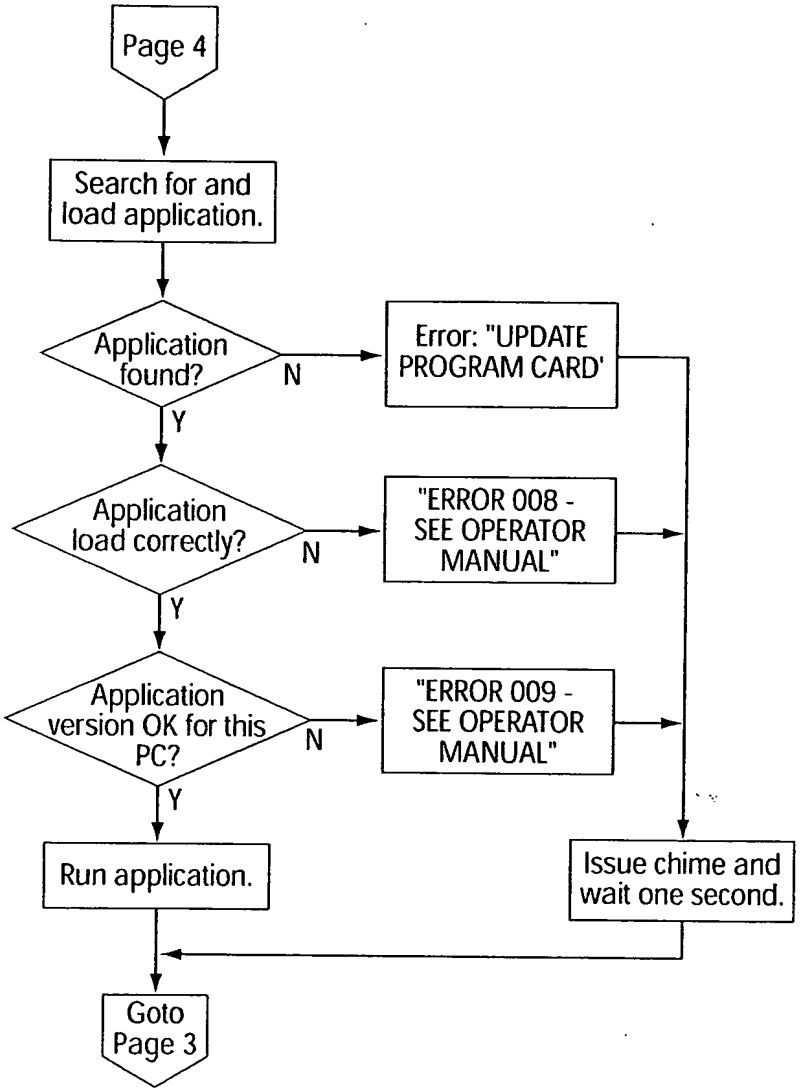

Page 4
Search for and load application.
Application found?
N
Error: "UPDATE PROGRAM CARD'
Y
Application load correctly?
N
"ERROR 008 - SEE OPERATOR MANUAL"
Y
Application version OK for this PC?
N
"ERROR 009 - SEE OPERATOR MANUAL"
Y
Run application.
Issue chime and wait one second.
Goto Page 3

Fig. 17d

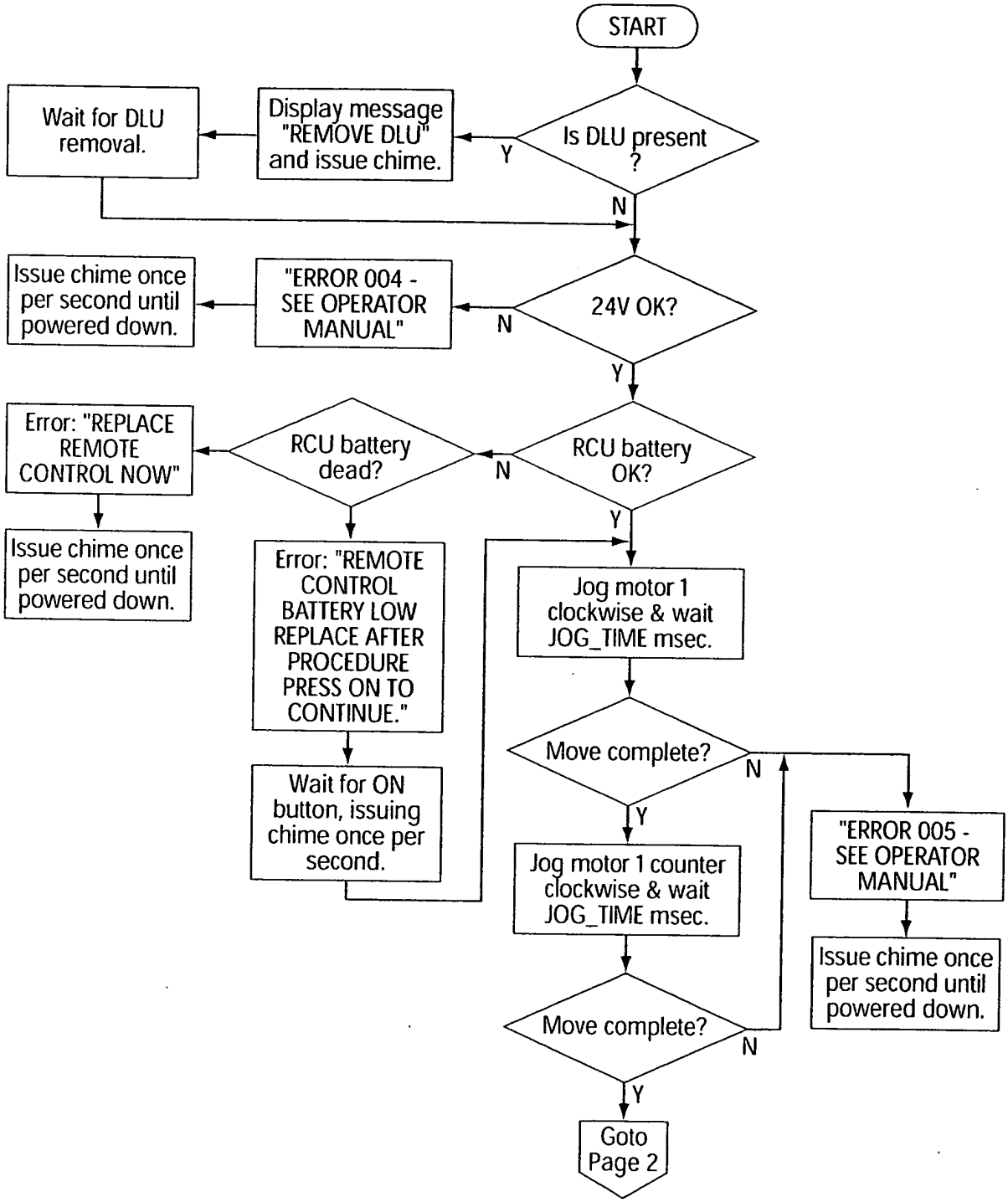

START
Is DLU present ?
Y
Display message "REMOVE DLU" and issue chime.
Wait for DLU removal.
N
24V OK?
N
"ERROR 004 - SEE OPERATOR MANUAL"
Issue chime once per second until powered down.
Y
RCU battery OK?
N
RCU battery dead?
Error: "REPLACE REMOTE CONTROL NOW"
Issue chime once per second until powered down.
Y
Jog motor 1 clockwise & wait JOG_TIME msec.
Move complete?
N
"ERROR 005 - SEE OPERATOR MANUAL"
Issue chime once per second until powered down.
Y
Jog motor 1 counter clockwise & wait JOG_TIME msec.
Move complete?
N
Y
Goto Page 2
Error: "REMOTE CONTROL BATTERY LOW REPLACE AFTER PROCEDURE PRESS ON TO CONTINUE."
Wait for ON button, issuing chime once per second.

Fig. 18a

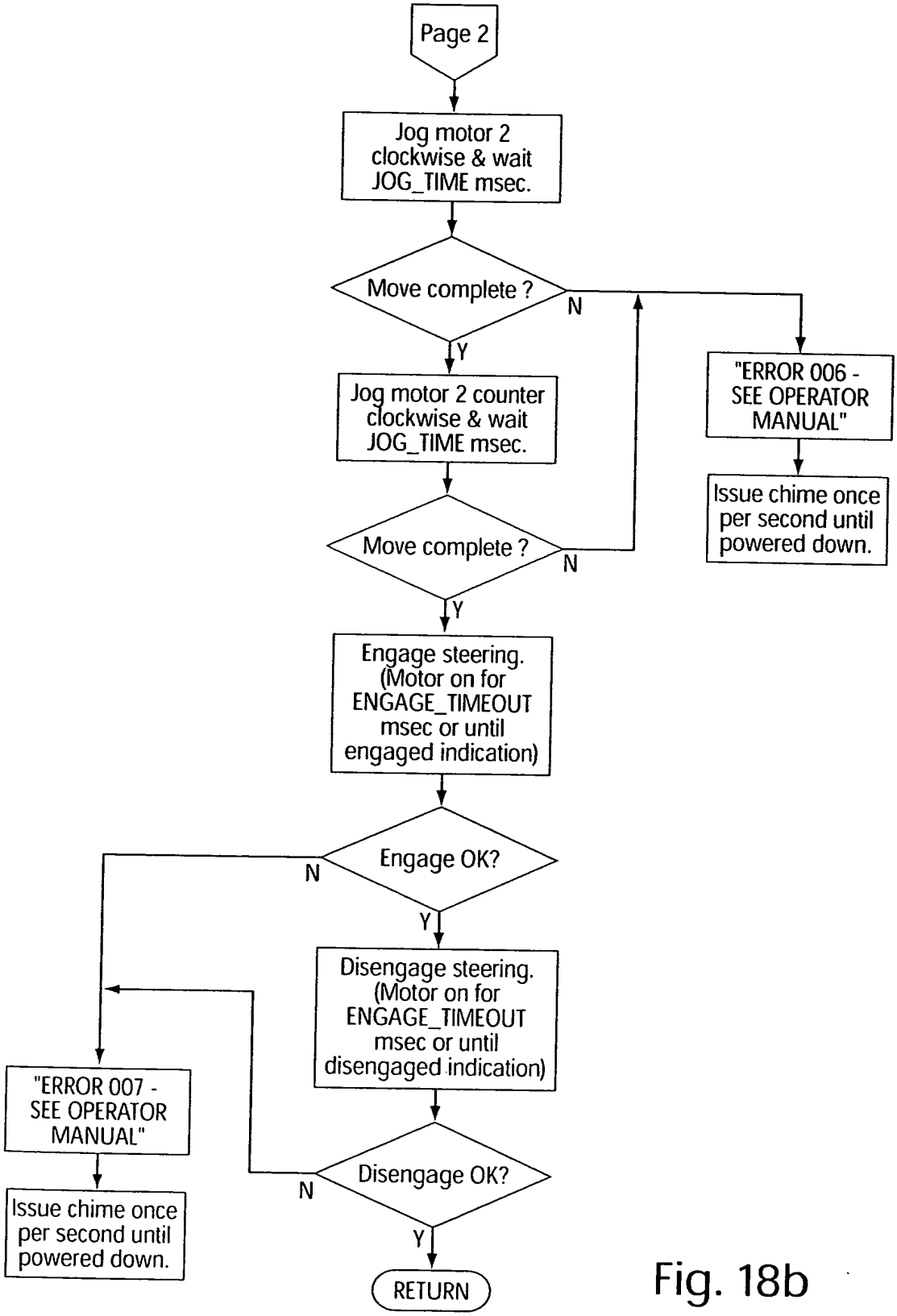

Page 2
Jog motor 2 clockwise & wait JOG_TIME msec.
Move complete ?
N
Y
"ERROR 006 - SEE OPERATOR MANUAL"
Issue chime once per second until powered down.
Jog motor 2 counter clockwise & wait JOG_TIME msec.
Move complete ?
N
Y
Engage steering. (Motor on for ENGAGE_TIMEOUT msec or until engaged indication)
Engage OK?
N
Y
"ERROR 007 - SEE OPERATOR MANUAL"
Issue chime once per second until powered down.
Disengage steering. (Motor on for ENGAGE_TIMEOUT msec or until disengaged indication)
Disengage OK?
N
Y
RETURN

Fig. 18b

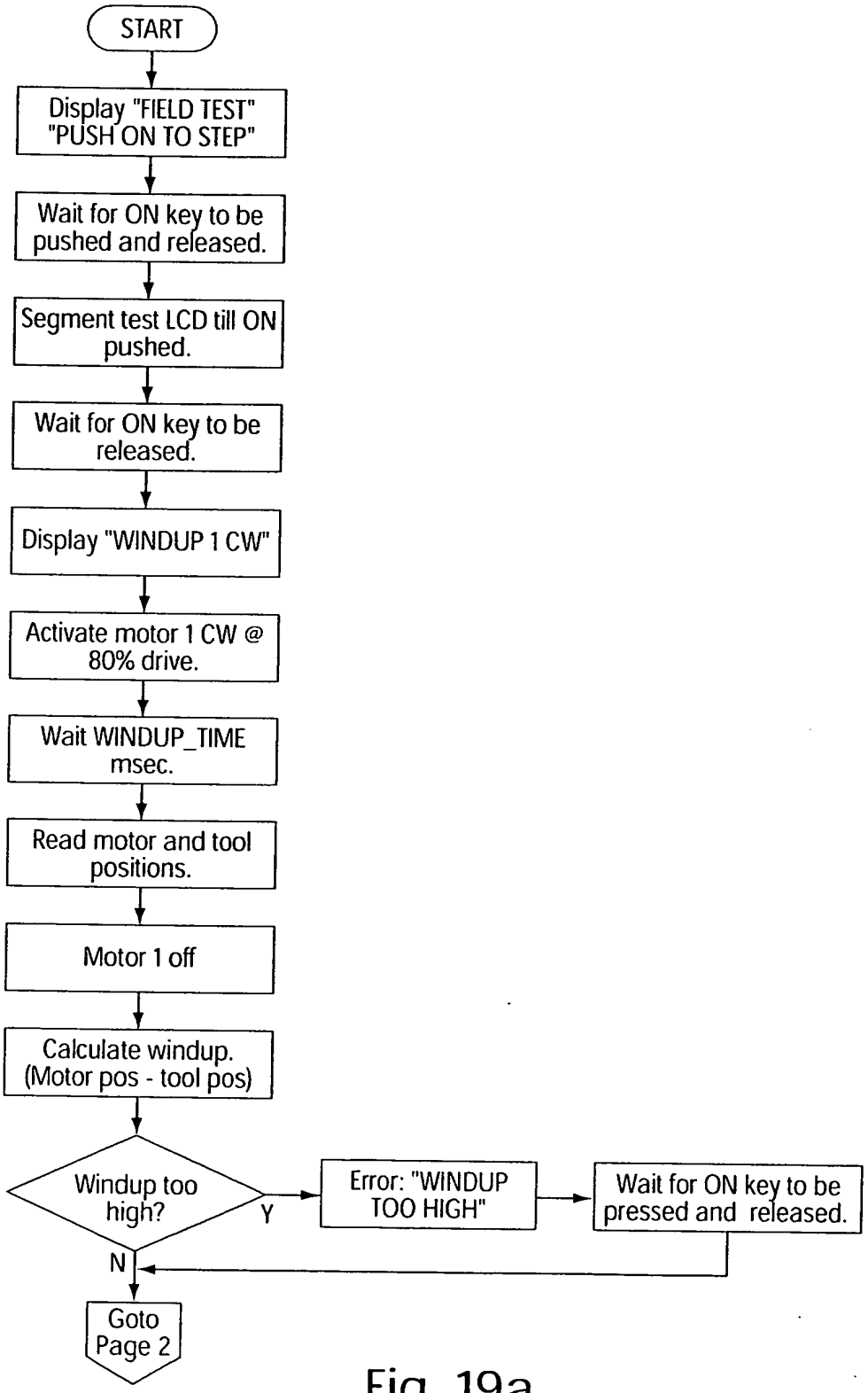

START
Display "FIELD TEST" "PUSH ON TO STEP"
Wait for ON key to be pushed and released.
Segment test LCD till ON pushed.
Wait for ON key to be released.
Display "WINDUP 1 CW"
Activate motor 1 CW @ 80% drive.
Wait WINDUP_TIME msec.
Read motor and tool positions.
Motor 1 off
Calculate windup. (Motor pos - tool pos)
Windup too high?
Y
Error: "WINDUP TOO HIGH"
Wait for ON key to be pressed and released.
N
Goto Page 2

Fig. 19a

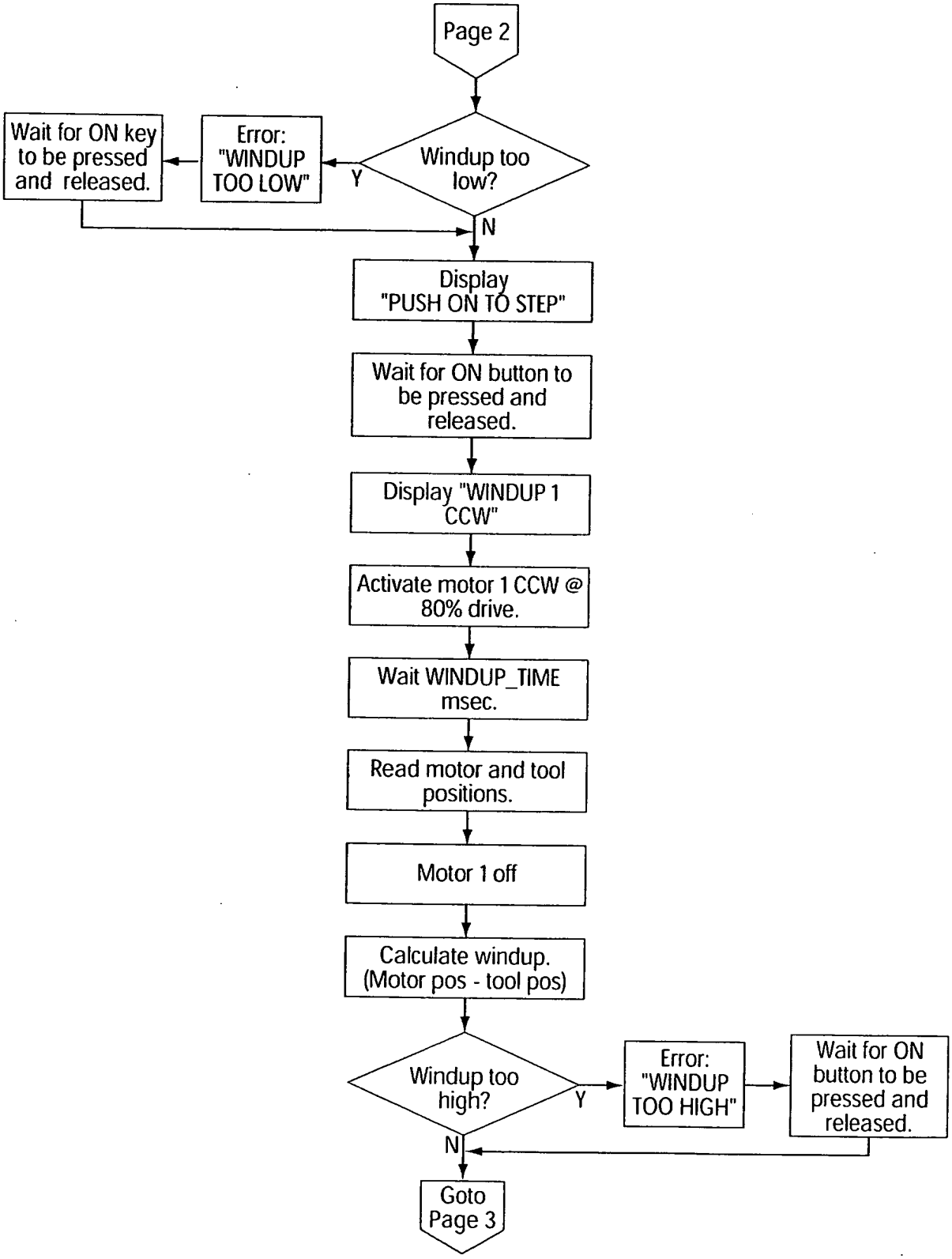

Page 2
Windup too low?
Y
Error: "WINDUP TOO LOW"
Wait for ON key to be pressed and released.
N
Display "PUSH ON TO STEP"
Wait for ON button to be pressed and released.
Display "WINDUP 1 CCW"
Activate motor 1 CCW @ 80% drive.
Wait WINDUP_TIME msec.
Read motor and tool positions.
Motor 1 off
Calculate windup. (Motor pos - tool pos)
Windup too high?
Y
Error: "WINDUP TOO HIGH"
Wait for ON button to be pressed and released.
N
Goto Page 3

Fig. 19b

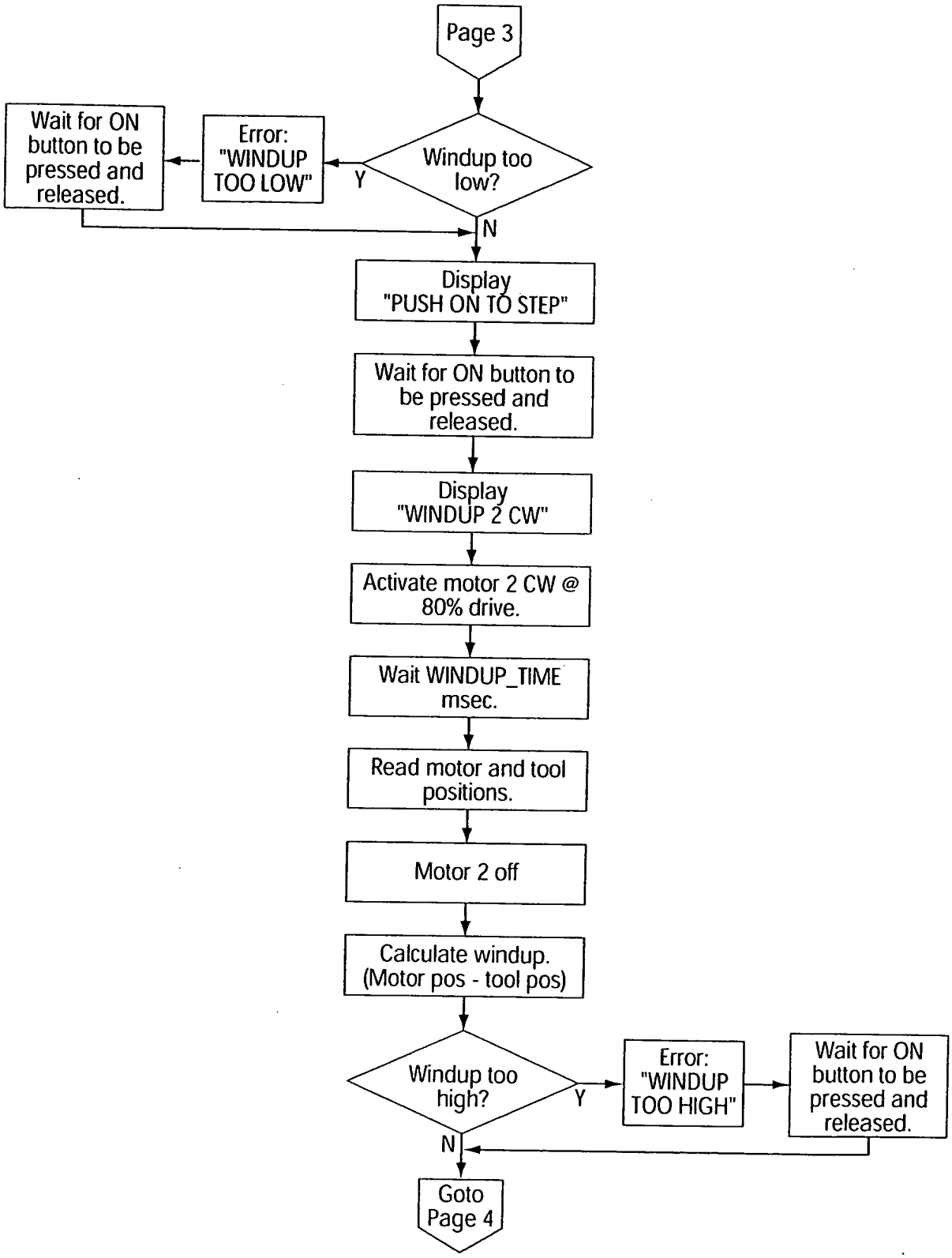

Page 3
Windup too low?
Y
Error: "WINDUP TOO LOW"
Wait for ON button to be pressed and released.
N
Display "PUSH ON TO STEP"
Wait for ON button to be pressed and released.
Display "WINDUP 2 CW"
Activate motor 2 CW @ 80% drive.
Wait WINDUP_TIME msec.
Read motor and tool positions.
Motor 2 off
Calculate windup. (Motor pos - tool pos)
Windup too high?
Y
Error: "WINDUP TOO HIGH"
Wait for ON button to be pressed and released.
N
Goto Page 4

Fig. 19c

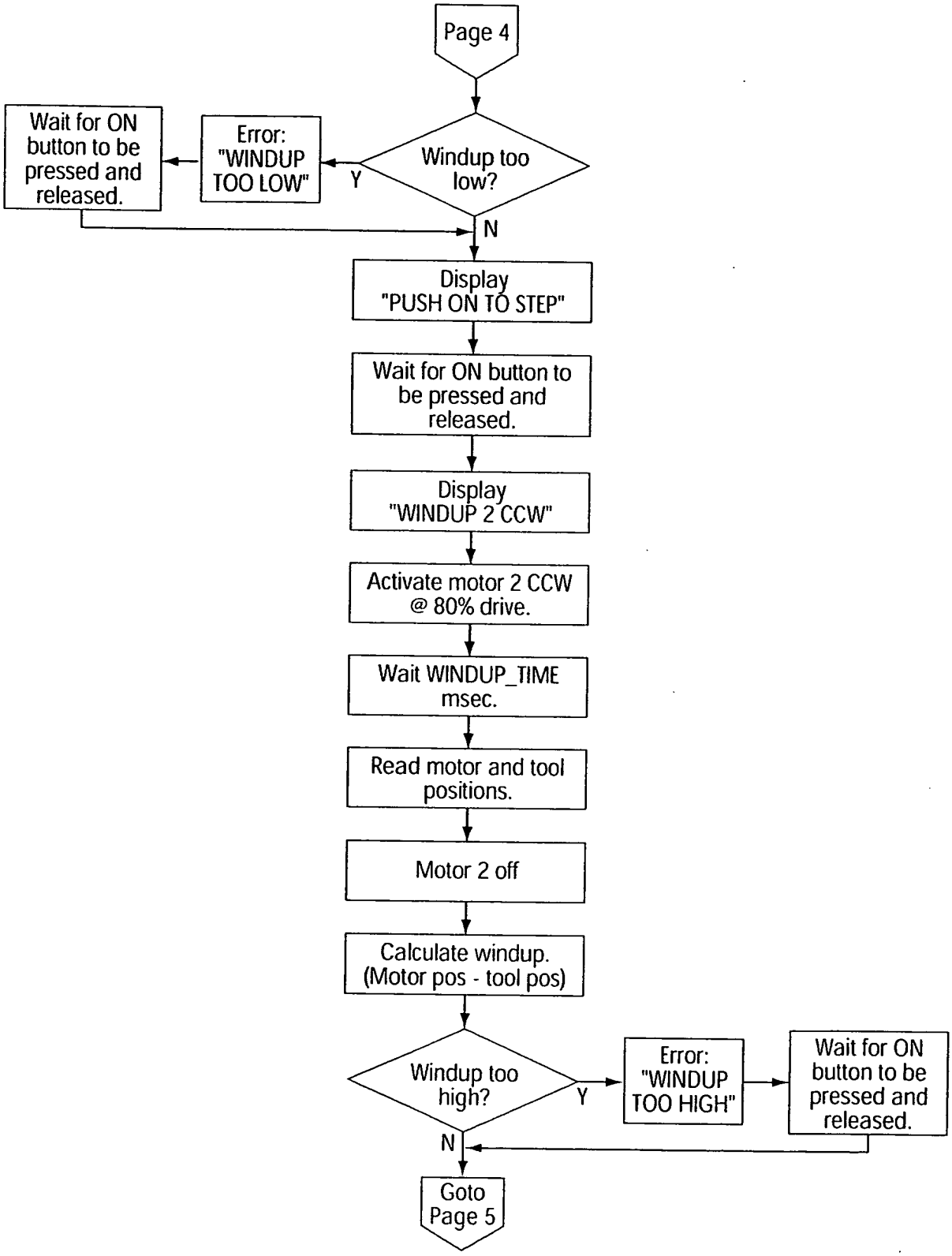

Page 4
Windup too low?
Y
Error: "WINDUP TOO LOW"
Wait for ON button to be pressed and released.
N
Display "PUSH ON TO STEP"
Wait for ON button to be pressed and released.
Display "WINDUP 2 CCW"
Activate motor 2 CCW @ 80% drive.
Wait WINDUP_TIME msec.
Read motor and tool positions.
Motor 2 off
Calculate windup. (Motor pos - tool pos)
Windup too high?
Y
Error: "WINDUP TOO HIGH"
Wait for ON button to be pressed and released.
N
Goto Page 5

Fig. 19d

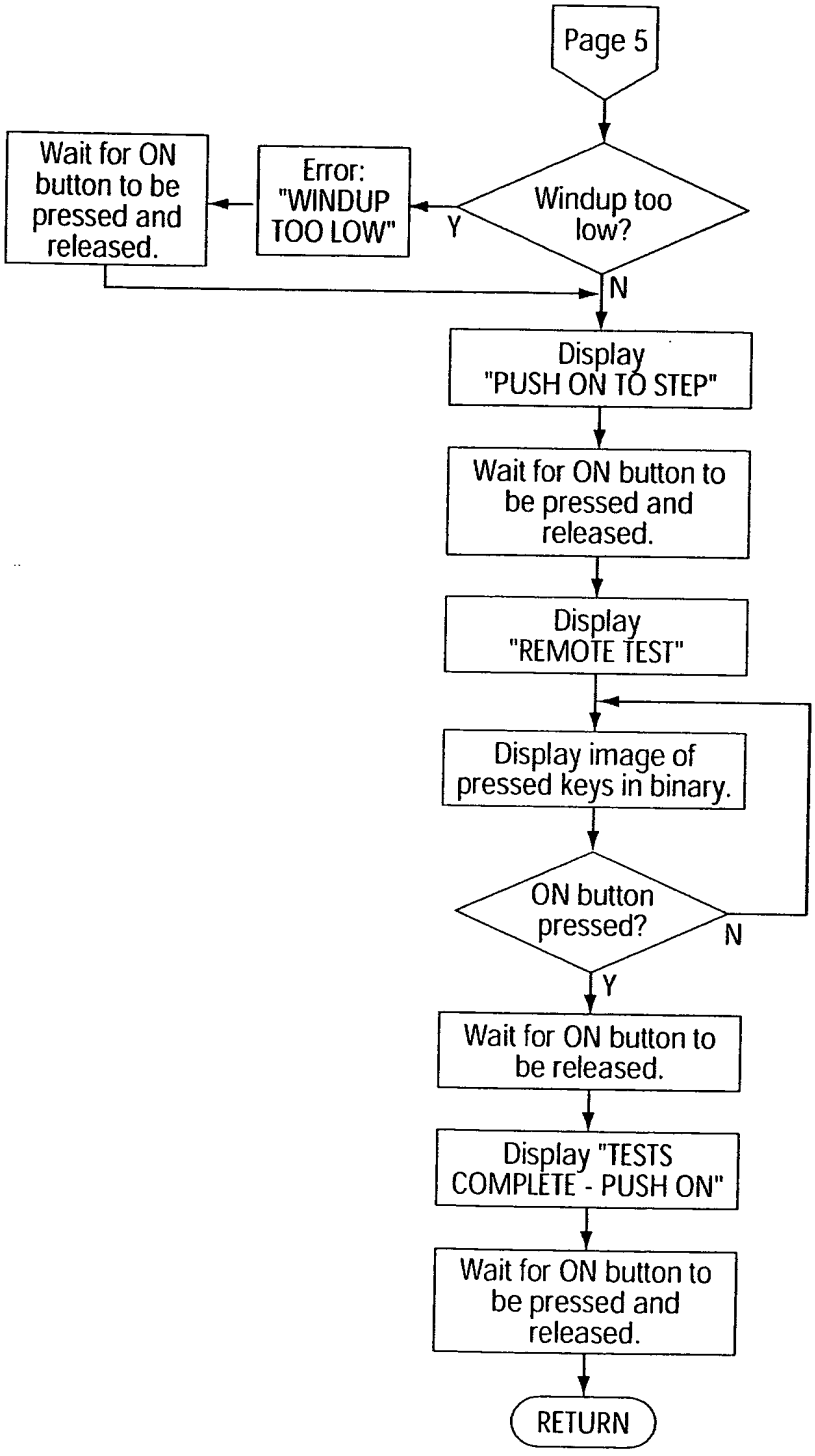

Page 5
Windup too low?
Y
Error: "WINDUP TOO LOW"
Wait for ON button to be pressed and released.
N
Display "PUSH ON TO STEP"
Wait for ON button to be pressed and released.
Display "REMOTE TEST"
Display image of pressed keys in binary.
ON button pressed?
N
Y
Wait for ON button to be released.
Display "TESTS COMPLETE - PUSH ON"
Wait for ON button to be pressed and released.
RETURN

Fig. 19e

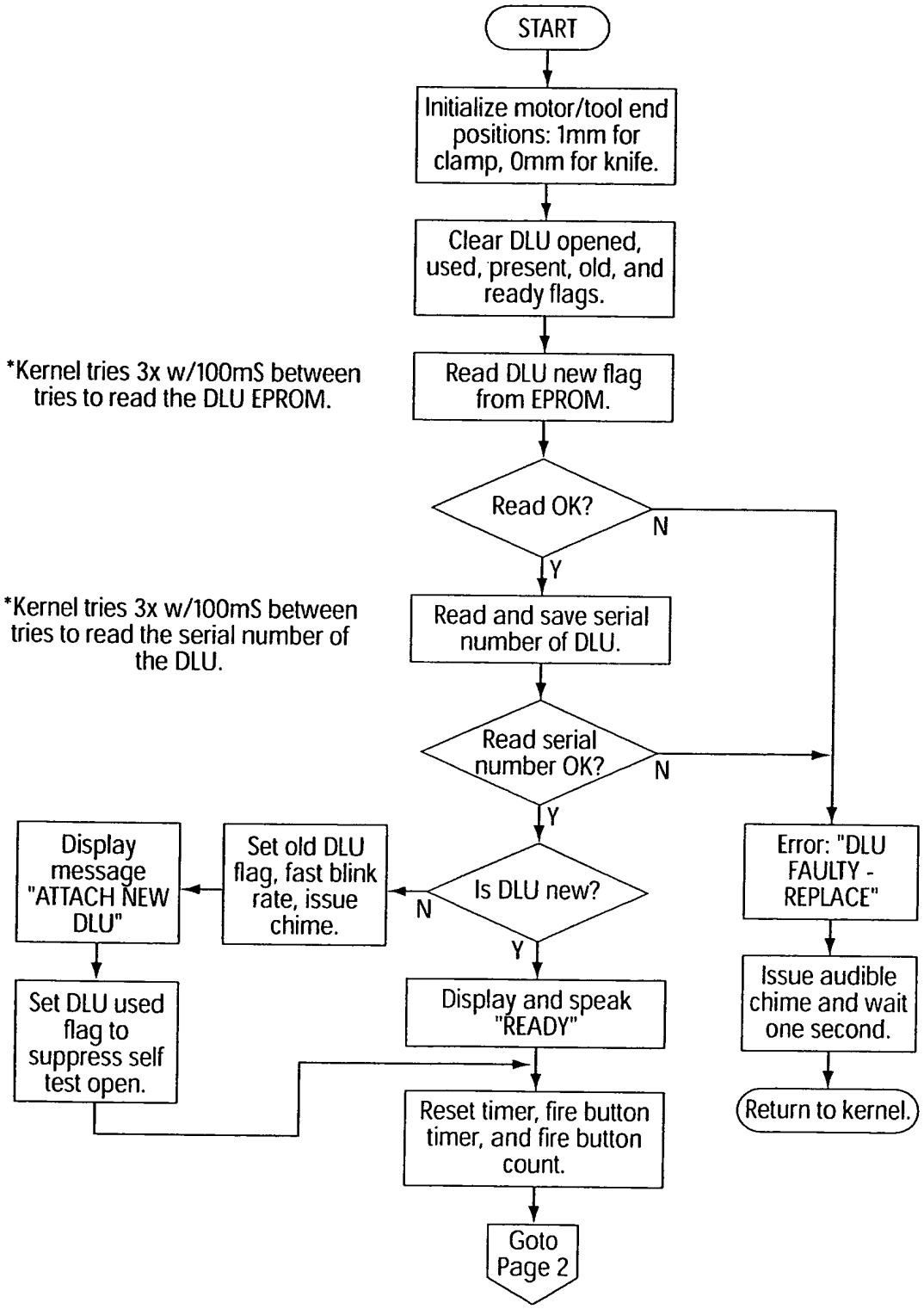

START
Initialize motor/tool end positions: 1mm for clamp, 0mm for knife.
Clear DLU opened, used, present, old, and ready flags.
*Kernel tries 3x w/100mS between tries to read the DLU EPROM.
Read DLU new flag from EPROM.
Read OK?
N
Y
*Kernel tries 3x w/100mS between tries to read the serial number of the DLU.
Read and save serial number of DLU.
Read serial number OK?
N
Y
Error: "DLU FAULTY - REPLACE"
Issue audible chime and wait one second.
Return to kernel.
Is DLU new?
N
Y
Set old DLU flag, fast blink rate, issue chime.
Display message "ATTACH NEW DLU"
Set DLU used flag to suppress self test open.
Display and speak "READY"
Reset timer, fire button timer, and fire button count.
Goto Page 2

Fig. 20a

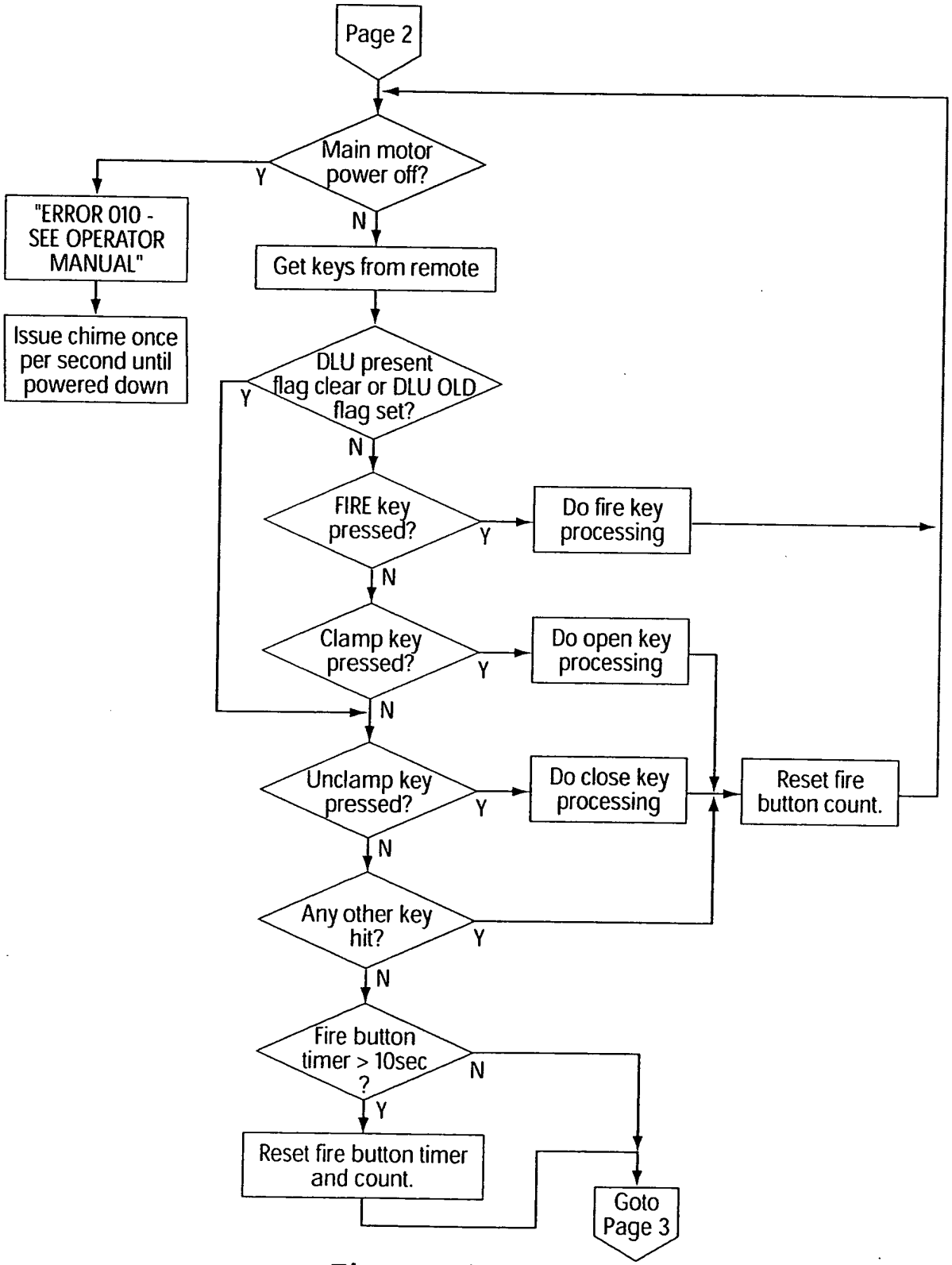

Page 2
Main motor power off?
Y
N
"ERROR 010 - SEE OPERATOR MANUAL"
Issue chime once per second until powered down
Get keys from remote
DLU present flag clear or DLU OLD flag set?
Y
N
FIRE key pressed?
Y
Do fire key processing
N
Clamp key pressed?
Y
Do open key processing
N
Unclamp key pressed?
Y
Do close key processing
Reset fire button count.
N
Any other key hit?
Y
N
Fire button timer > 10sec ?
N
Y
Reset fire button timer and count.
Goto Page 3

Fig. 20b

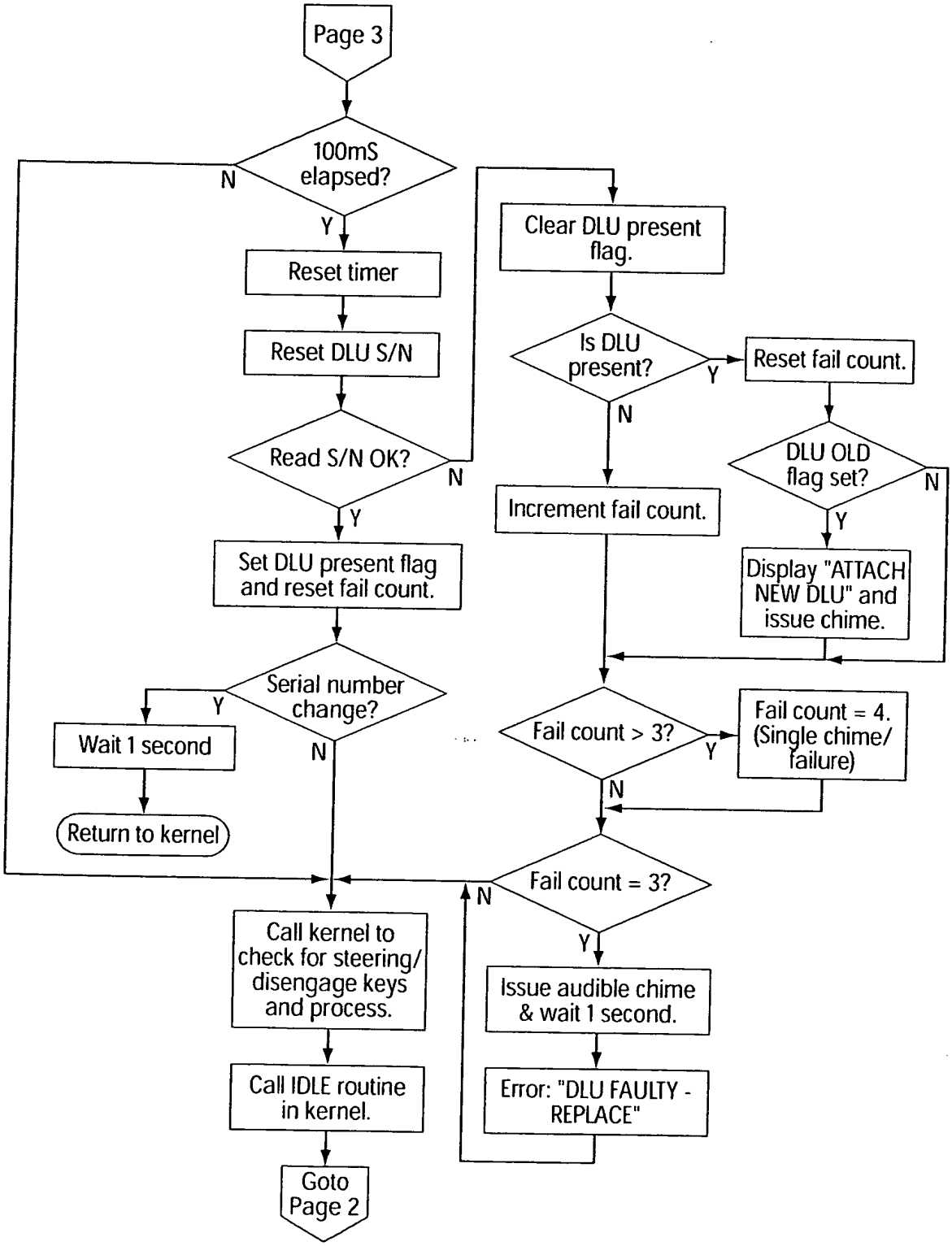

Page 3
100mS elapsed?
N
Y
Reset timer
Reset DLU S/N
Read S/N OK?
N
Y
Set DLU present flag and reset fail count.
Serial number change?
Y
N
Wait 1 second
Return to kernel
Call kernel to check for steering/ disengage keys and process.
Call IDLE routine in kernel.
Goto Page 2
Clear DLU present flag.
Is DLU present?
Y
N
Reset fail count.
DLU OLD flag set?
N
Y
Display "ATTACH NEW DLU" and issue chime.
Increment fail count.
Fail count > 3?
Y
N
Fail count = 4. (Single chime/ failure)
Fail count = 3?
N
Y
Issue audible chime & wait 1 second.
Error: "DLU FAULTY - REPLACE"

Fig. 20c

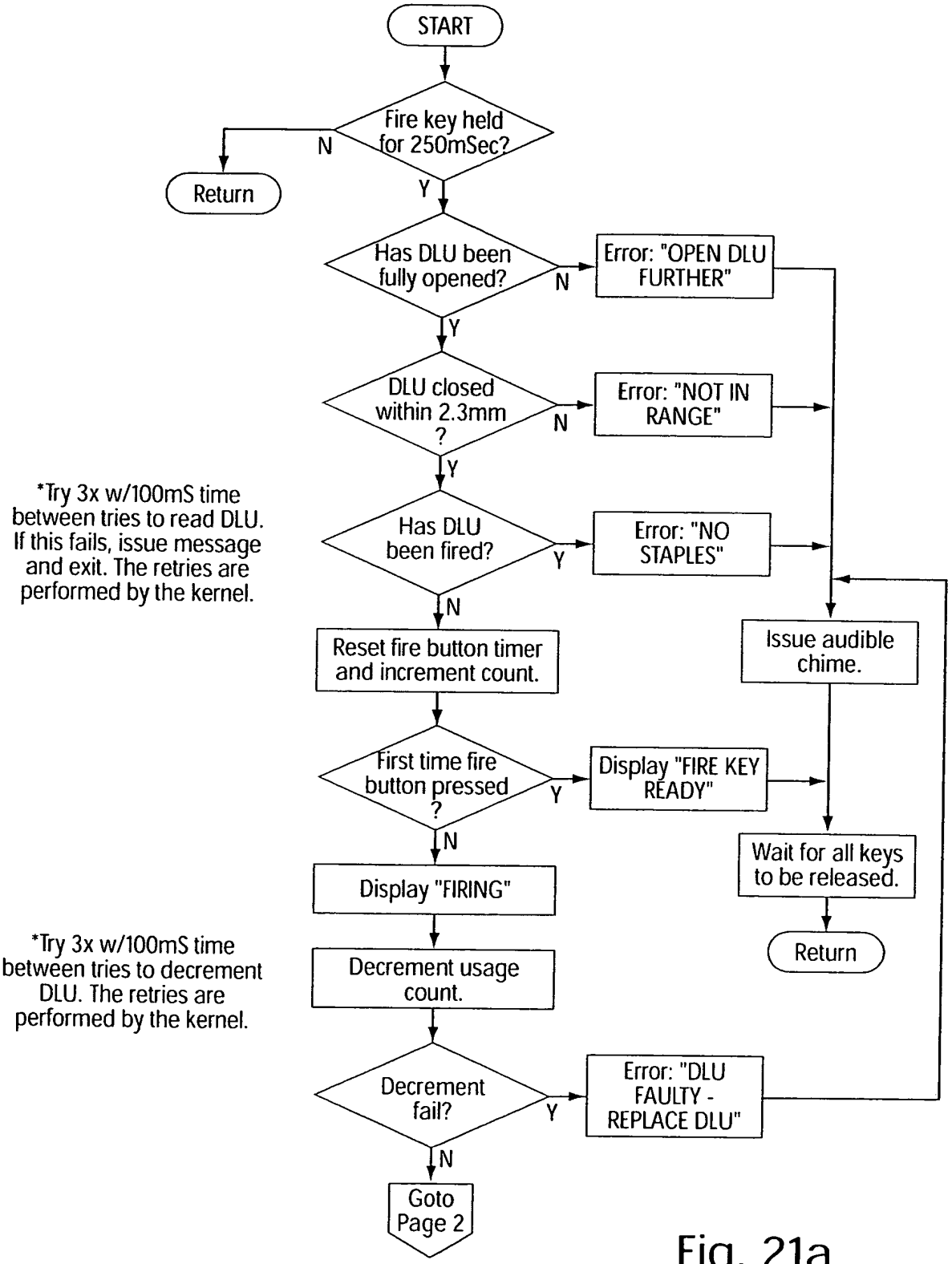

START
Fire key held for 250mSec?
N
Return
Y
Has DLU been fully opened?
N
Error: "OPEN DLU FURTHER"
Y
DLU closed within 2.3mm ?
N
Error: "NOT IN RANGE"
Y
Has DLU been fired?
Y
Error: "NO STAPLES"
N
Reset fire button timer and increment count.
First time fire button pressed ?
Y
Display "FIRE KEY READY"
N
Display "FIRING"
Decrement usage count.
Decrement fail?
Y
Error: "DLU FAULTY - REPLACE DLU"
N
Goto Page 2
Issue audible chime.
Wait for all keys to be released.
Return
*Try 3x w/100mS time between tries to read DLU. If this fails, issue message and exit. The retries are performed by the kernel.
*Try 3x w/100mS time between tries to decrement DLU. The retries are performed by the kernel.

Fig. 21a

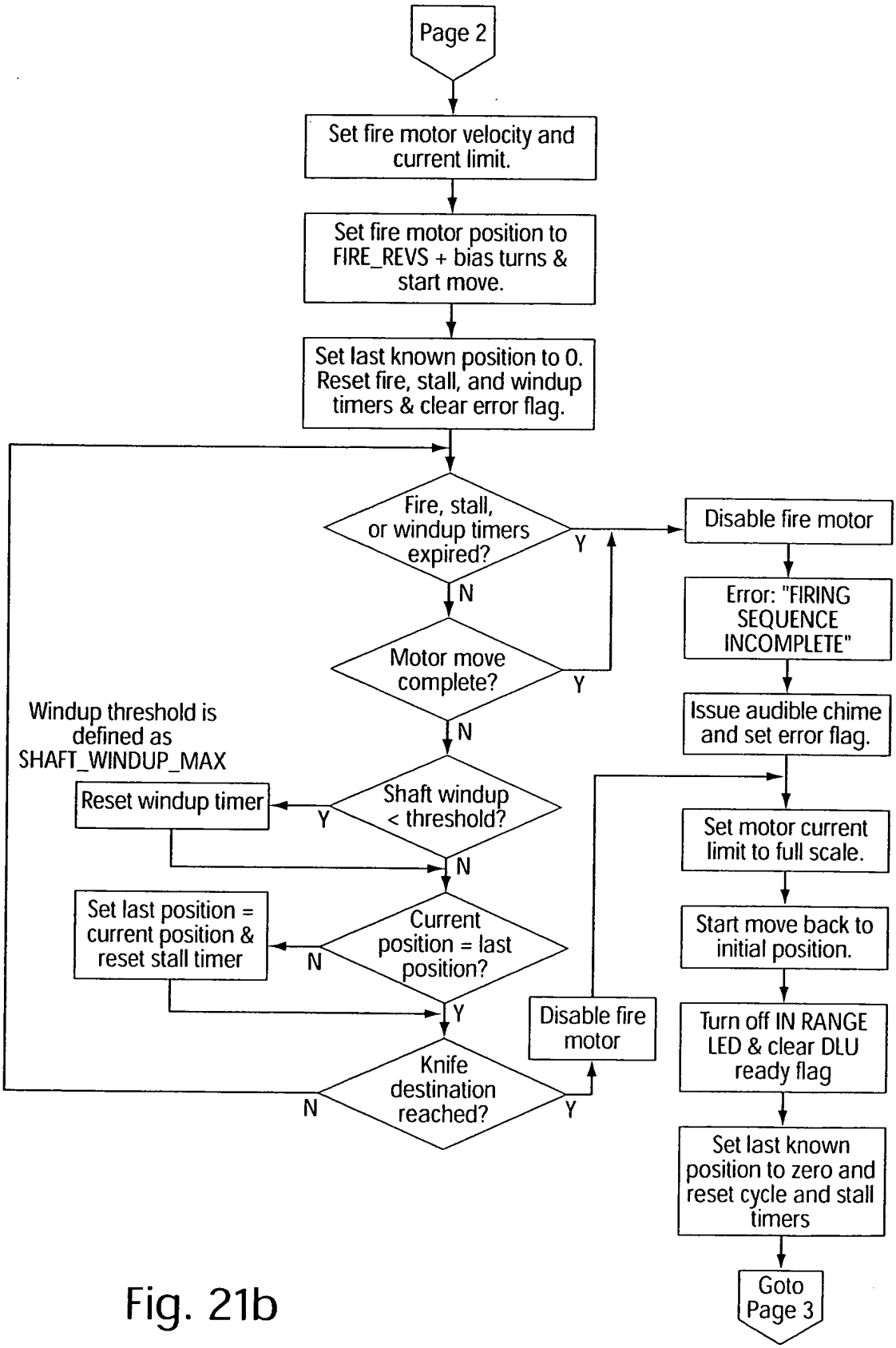

Page 2
Set fire motor velocity and current limit.
Set fire motor position to FIRE_REVS + bias turns & start move.
Set last known position to 0. Reset fire, stall, and windup timers & clear error flag.
Fire, stall, or windup timers expired?
Y
N
Disable fire motor
Error: "FIRING SEQUENCE INCOMPLETE"
Issue audible chime and set error flag.
Motor move complete?
Y
N
Windup threshold is defined as SHAFT_WINDUP_MAX
Shaft windup < threshold?
Y
N
Reset windup timer
Set motor current limit to full scale.
Start move back to initial position.
Current position = last position?
N
Y
Set last position = current position & reset stall timer
Disable fire motor
Turn off IN RANGE LED & clear DLU ready flag
Knife destination reached?
N
Y
Set last known position to zero and reset cycle and stall timers
Goto Page 3

Fig. 21b

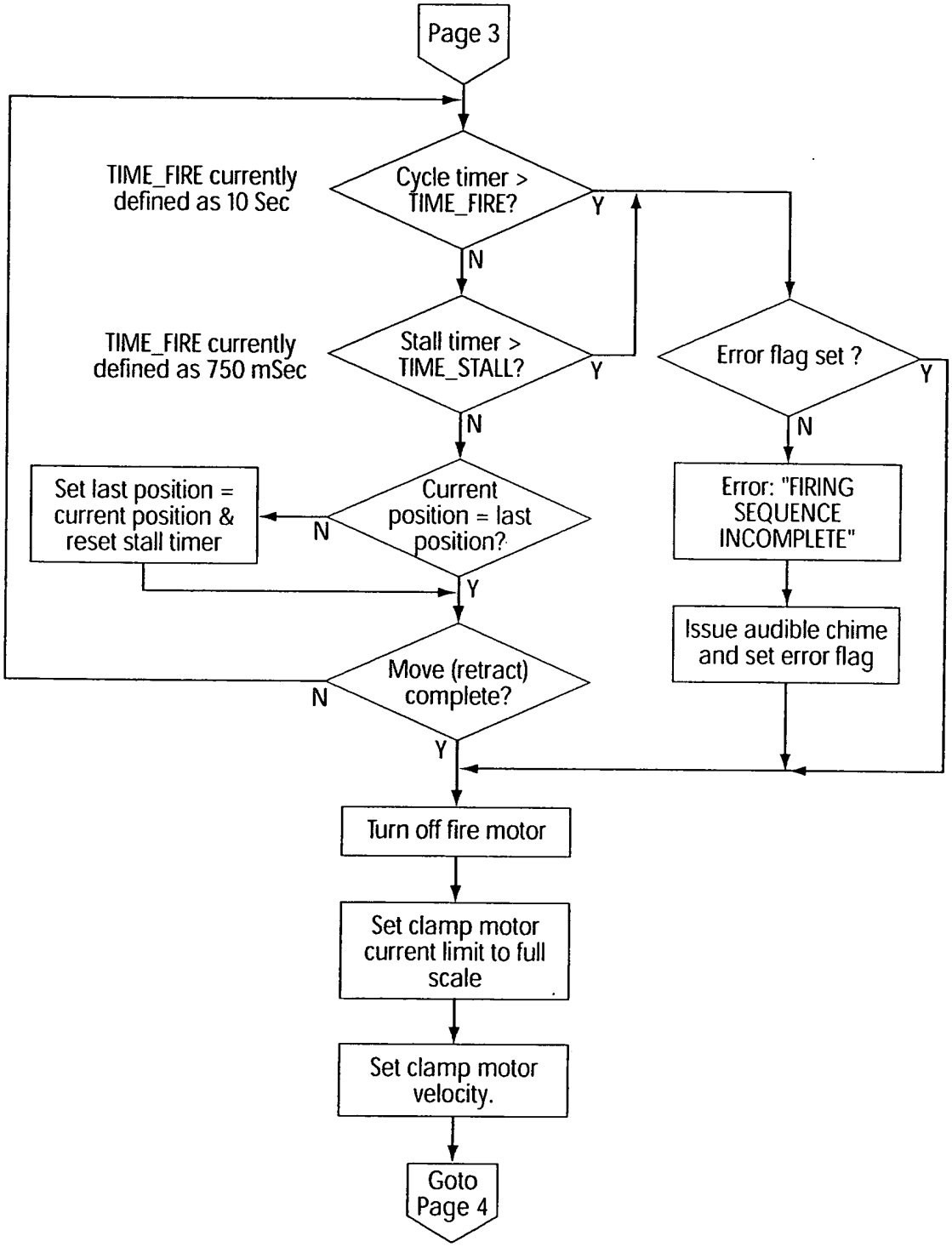

Page 3
TIME_FIRE currently defined as 10 Sec
Cycle timer > TIME_FIRE?
Y
N
TIME_FIRE currently defined as 750 mSec
Stall timer > TIME_STALL?
Y
N
Error flag set ?
Y
N
Set last position = current position & reset stall timer
N
Current position = last position?
Y
Error: "FIRING SEQUENCE INCOMPLETE"
Issue audible chime and set error flag
N
Move (retract) complete?
Y
Turn off fire motor
Set clamp motor current limit to full scale
Set clamp motor velocity.
Goto Page 4

Fig. 21c

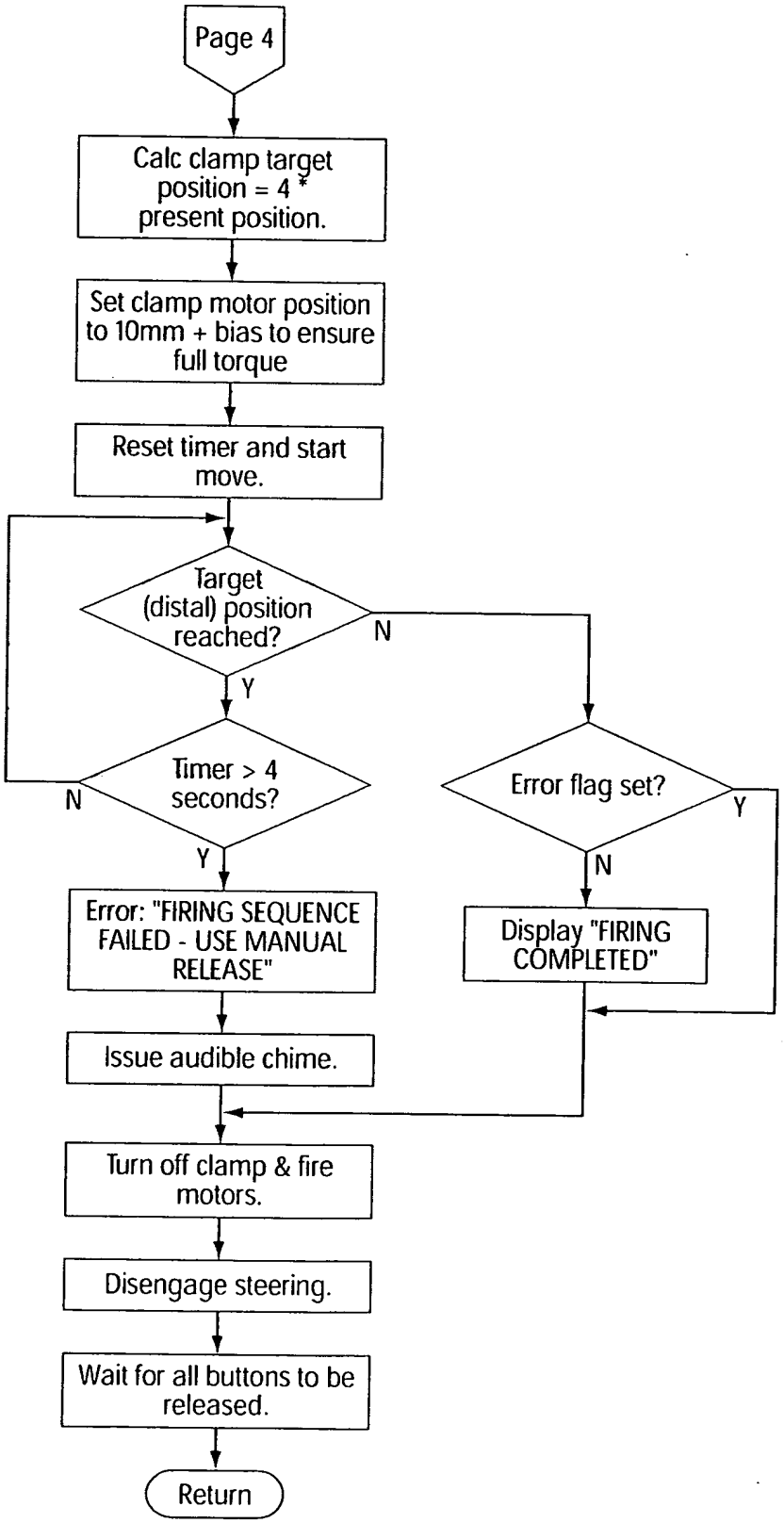

Page 4
Calc clamp target position = 4 * present position.
Set clamp motor position to 10mm + bias to ensure full torque
Reset timer and start move.
Target (distal) position reached?
N
Y
Timer > 4 seconds?
N
Y
Error flag set?
Y
N
Error: "FIRING SEQUENCE FAILED - USE MANUAL RELEASE"
Display "FIRING COMPLETED"
Issue audible chime.
Turn off clamp & fire motors.
Disengage steering.
Wait for all buttons to be released.
Return

Fig. 21d

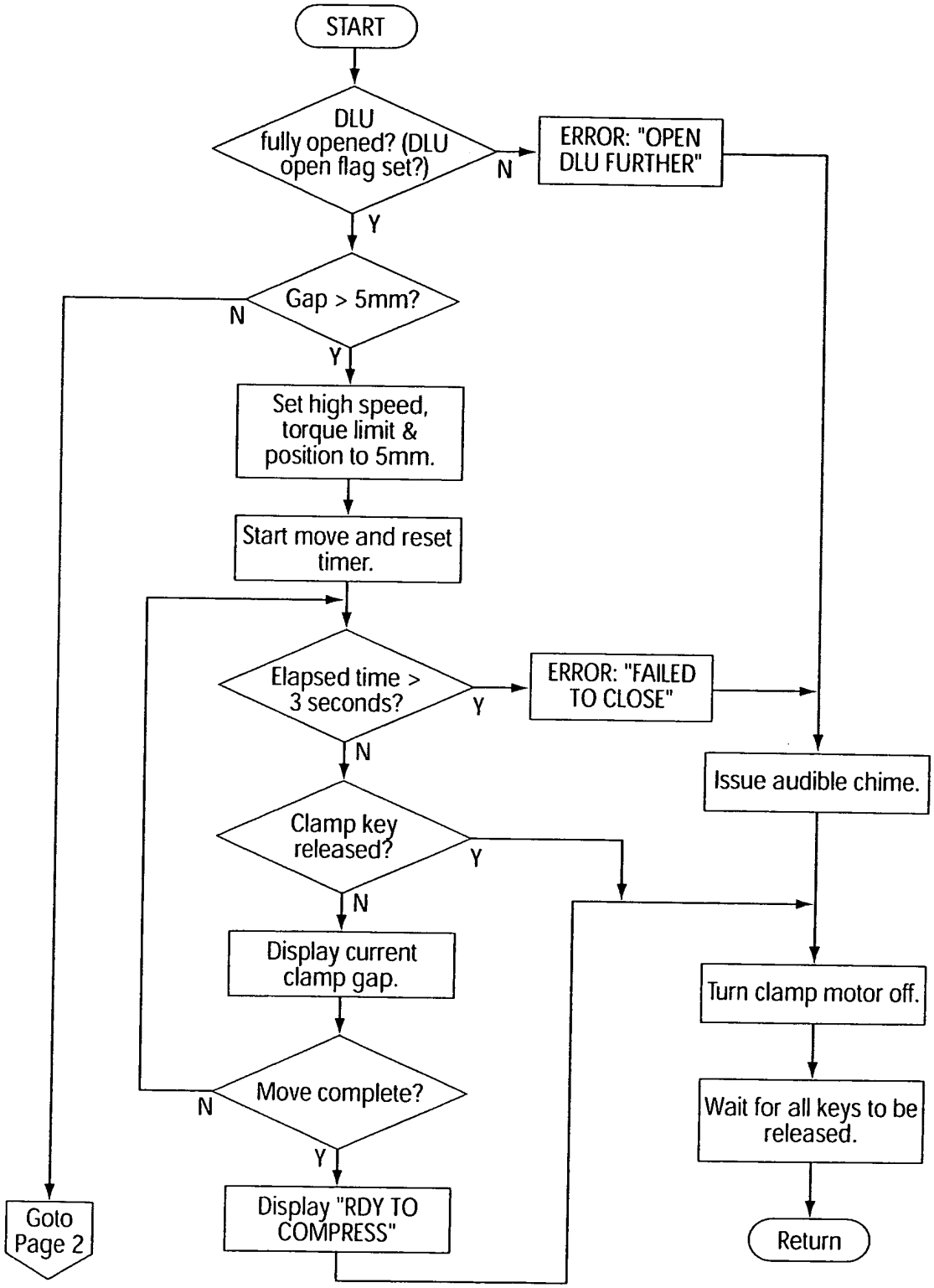

START
DLU fully opened? (DLU open flag set?)
N
ERROR: "OPEN DLU FURTHER"
Y
Gap > 5mm?
N
Y
Set high speed, torque limit & position to 5mm.
Start move and reset timer.
Elapsed time > 3 seconds?
Y
ERROR: "FAILED TO CLOSE"
N
Issue audible chime.
Clamp key released?
Y
N
Display current clamp gap.
Turn clamp motor off.
Move complete?
N
Y
Wait for all keys to be released.
Display "RDY TO COMPRESS"
Goto Page 2
Return

Fig. 22a

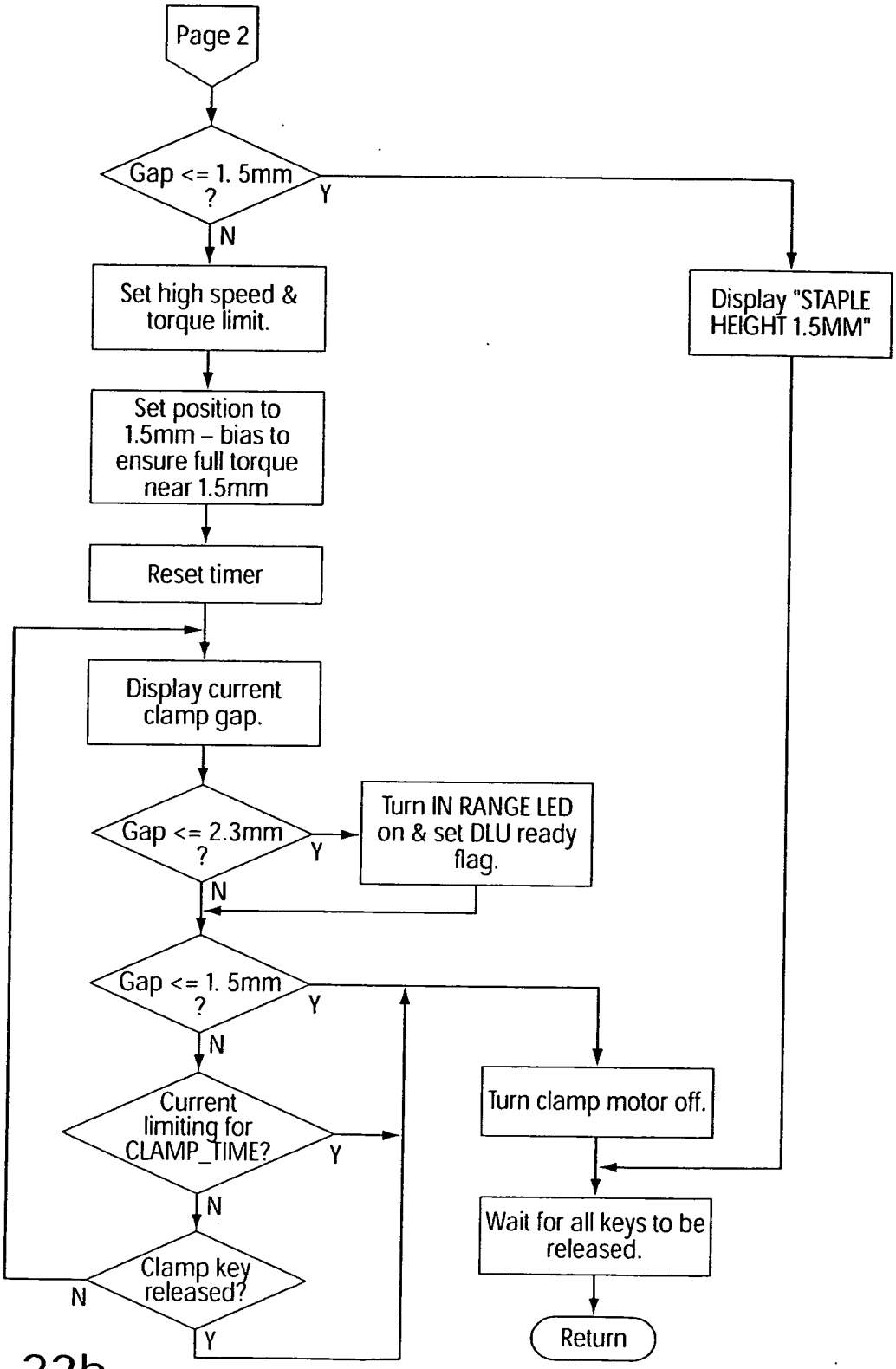

Page 2
Gap <= 1. 5mm ?
Y
N
Set high speed & torque limit.
Display "STAPLE HEIGHT 1.5MM"
Set position to 1.5mm – bias to ensure full torque near 1.5mm
Reset timer
Display current clamp gap.
Gap <= 2.3mm ?
Y
Turn IN RANGE LED on & set DLU ready flag.
N
Gap <= 1. 5mm ?
Y
N
Current limiting for CLAMP_TIME?
Y
Turn clamp motor off.
N
Clamp key released?
N
Y
Wait for all keys to be released.
Return

Fig. 22b

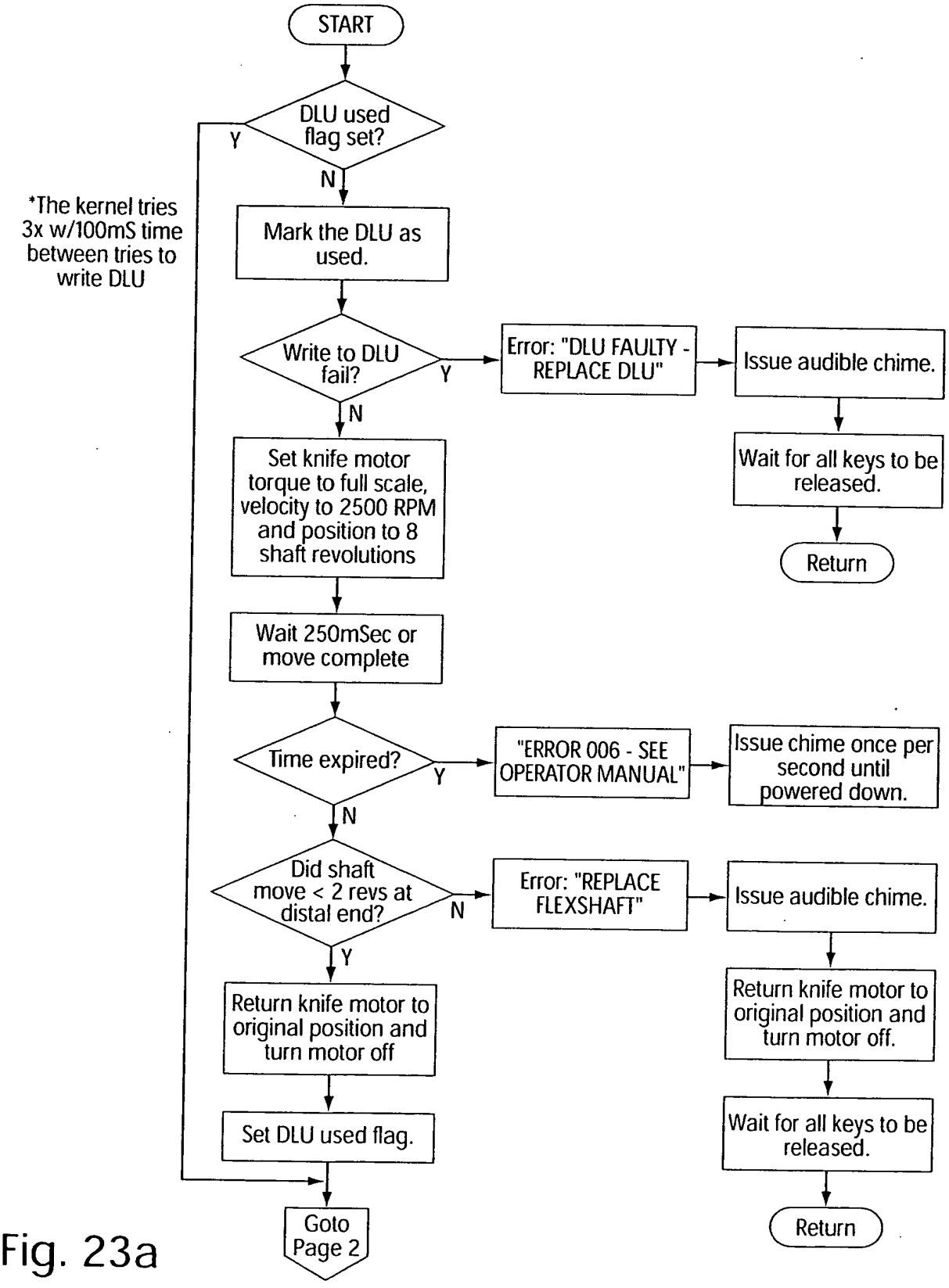

START
DLU used flag set?
Y
N
*The kernel tries 3x w/100mS time between tries to write DLU
Mark the DLU as used.
Write to DLU fail?
Y
Error: "DLU FAULTY - REPLACE DLU"
Issue audible chime.
Wait for all keys to be released.
Return
N
Set knife motor torque to full scale, velocity to 2500 RPM and position to 8 shaft revolutions
Wait 250mSec or move complete
Time expired?
Y
"ERROR 006 - SEE OPERATOR MANUAL"
Issue chime once per second until powered down.
N
Did shaft move < 2 revs at distal end?
N
Error: "REPLACE FLEXSHAFT"
Issue audible chime.
Return knife motor to original position and turn motor off.
Wait for all keys to be released.
Return
Y
Return knife motor to original position and turn motor off
Set DLU used flag.
Goto Page 2

Fig. 23a

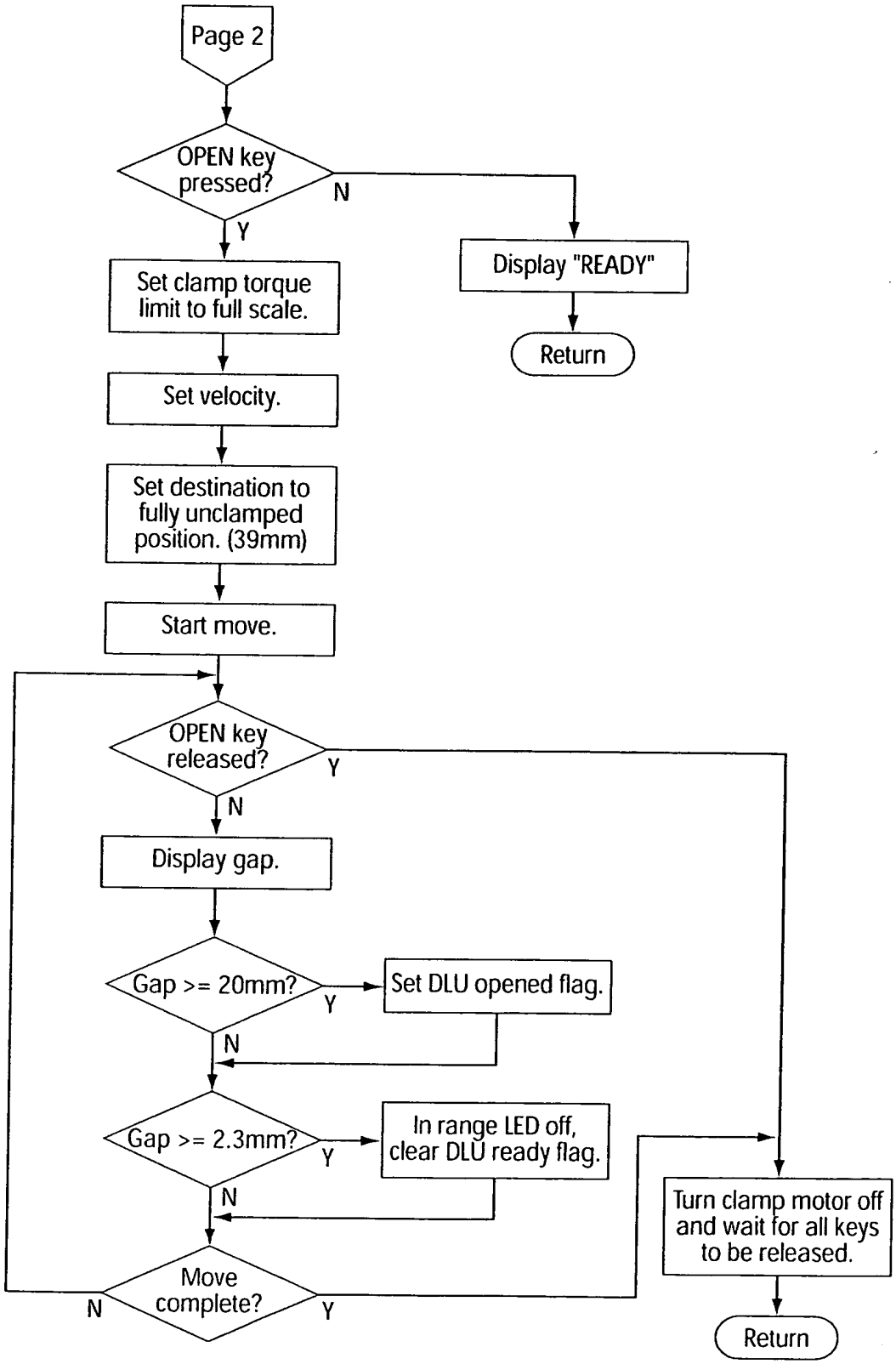

Page 2
OPEN key pressed?
N
Y
Display "READY"
Return
Set clamp torque limit to full scale.
Set velocity.
Set destination to fully unclamped position. (39mm)
Start move.
OPEN key released?
Y
N
Display gap.
Gap >= 20mm?
Y
Set DLU opened flag.
N
Gap >= 2.3mm?
Y
In range LED off, clear DLU ready flag.
N
Move complete?
N
Y
Turn clamp motor off and wait for all keys to be released.
Return

Fig. 23b